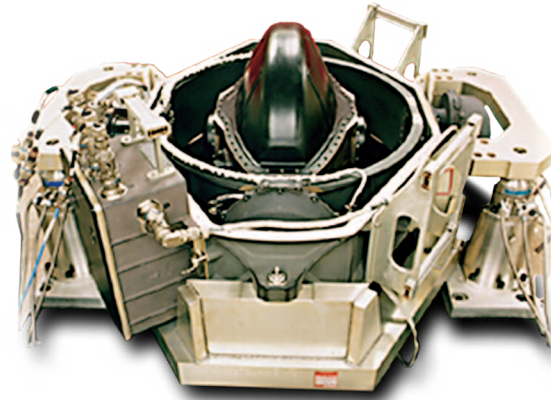
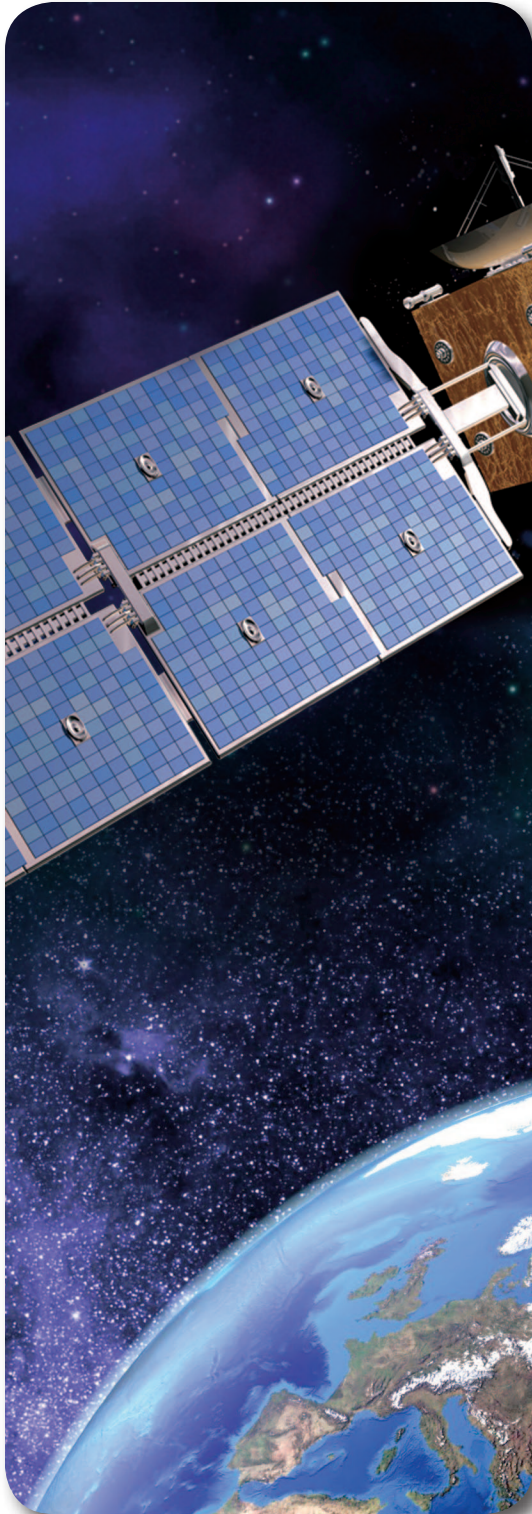


Double-Gimbal CMG



THE POWER TO MOVE THE SPACE WORLD

L-3 Space & Navigation (L-3 S&N) is a premier supplier of Momentum Exchange Devices, including Momentum Wheels, Reaction Wheels, and Control Moment Gyros (CMGs). Four CMGs designed, built and tested by L-3 S&N are mounted on the Z1 truss of the International Space Station (ISS). The CMGs provide non-propulsive, electrically powered attitude control for the ISS.

The double gimbal system can point the spin axis or momentum vector, in any direction. The combined momentum storage capacity of the four CMGs is 19,000 Newton-meter-seconds (Nms). To maintain the ISS in the desired attitude, the CMG cancels or absorbs the momentum generated by the disturbance torques acting on the ISS, providing the key stabilization function critical to ISS mission success.

FEATURES

- Unlimited gimbal freedom
- Angular momentum rating 4760 Nms
- MIL-STD-1553-ready
- Nominal speed 6,600 rpm
- Extended design life to 10 years
- Lightweight
- Qualified for extended random vibration and operation in a thermal vacuum
- Currently installed on the ISS, manned space-based platform



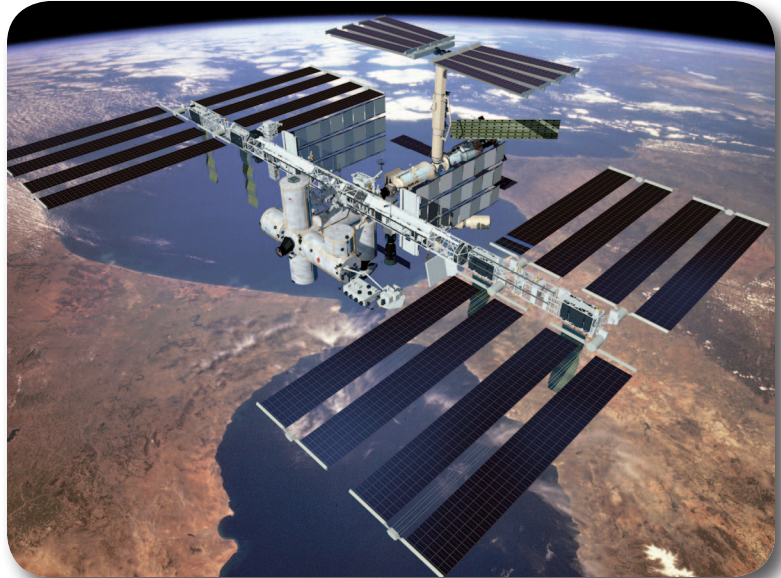
Specifications

PERFORMANCE

Design Life	10 yrs.
Angular Momentum	4760 Newton-meter-seconds (Nms)
Rotor Factor of Safety	4 minimum (yield)
Nominal Speed	6,600 rpm
Maximum Output Torque	258 Newton-meter (Nm)
Maximum Gimbal Rate	± 3.1 °/sec.
Data Transfer	MIL-STD-1553

CHARACTERISTICS

Weight	600 lb., 272 kg
Dimensions	51 in. L x 54 in. W x 48.5 in. H 130 cm L x 137 cm W x 125 cm H
Input Power	120 VDC
Unlimited Gimbal Freedom	Both axes
Qualified to:	
Random Vibration	8.25 G _{RMS} (Root-Mean-Square)
Thermal Vacuum	-54 °C to +71 °C



International Space Station

APPLICATION NOTE

A Control Momentum Gyroscope (CMG) is an attitude control device used in spacecraft attitude control systems. A CMG typically consists of a spinning rotor and a gimbal control system that tilts the rotor's angular momentum. As the rotor tilts, the changing angular momentum causes a gyroscopic torque that rotates the spacecraft.

L-3 Space & Navigation CMGs can be utilized on major space-based platforms, such as the International Space Station (ISS). The ISS employs four L-3 CMGs as primary actuating devices during normal flight mode operation. The objective of the CMG flight control system is to hold the space station at a fixed attitude relative to the surface of the Earth. In addition, it seeks torque equilibrium, in which the combined torque contribution of the gravity gradient, atmospheric drag, solar pressure, and geomagnetic interactions are minimized. In the presence of these environmental disturbances, CMGs also act to absorb momentum in an attempt to maintain the space station at a desired attitude.

Methods for unloading CMG momentum include the use of magnetic torques, reaction thrusters, and gravity gradient torque. CMGs differ greatly from reaction wheels (RWAs). RWAs apply torque simply by changing rotor spin speed, while CMGs tilt the rotor's spin axis without changing spin speed. CMGs are also far more power efficient. As an example, for a few hundred watts and about 100 kg of mass, CMGs can produce thousands of Newton-meters of torque. An RWA of similar capability would require megawatts of power.

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