

Made with TELDIX wheel®

CMG 4-6S

A compact, cost-effective, high performance Control Momentum Gyroscope solution for the mini satellites widens the CMG family proposed by AIRBUS DS

A cost-effective solution for new-generation observation and science missions. The demand for agile satellites has increased considerably over the last few years, be it for commercial or military applications, Earth observation, astronomy, optical instruments or radar payloads. Even for mini satellites, when it comes to providing a high output torque (above 0.5 Nm typically) at reasonable mass, power

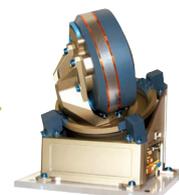
consumption and cost, reaction wheels are no match for small Control Moment Gyroscopes (CMGs). Besides the qualified CMG 15-45S for small satellites, AIRBUS DS and Rockwell Collins Deutschland have developed the CMG 4-6S (4 Nms, 6 Nm Standard), a compact, high performance CMG optimized for mini satellites.

Main application fields	Performances
<ul style="list-style-type: none"> Agile satellites for Earth observation Science missions 	<ul style="list-style-type: none"> Momentum: 4 Nms per CMG Torque: 6 Nm Gimbal axis angular range: Unlimited Life-time: 8 years gimbal manoeuvres: more than 3 000 000 Angular resolution: 22 bits Pointing performance: < 10 mrad Angular momentum stability: < 0.03%
Key Features	Interfaces
<ul style="list-style-type: none"> Brings to your 400kg class satellite a 3° /s agility in 2s Maximum compactness 6 Nm torque available, with only 1 Nm applied at gimbal, within 13 kg and 20 W: 10 times the torque of a classic wheel Easy satellite integration thanks to the limited foot print and the one side fixation principle Rigid preload in the bearings to withstand launch loads (no locking device) Auto failure detection for each channel Precise balancing of the wheel and very low friction in the gimbal bearings for very low disturbances 	<ul style="list-style-type: none"> Mass: 13 kg per CMG Volume: 270 mm x 225 mm x h 313 mm Power: 20 W idle - 64W manoeuvre Power bus: 22 - 37 V Dialog: MIL 1553B bus
Heritage	Availability
<ul style="list-style-type: none"> The CMG 4-6S uses same technologies as on currently flying on Pleiades SPOT 6 and SPOT 7 satellites with full customer satisfaction. 	<ul style="list-style-type: none"> EM development completed in 2013 Qualification pending until new contract award



CMG 15-45S on mounting bracket and damper with electronics and satellite harness

- Accommodation of electronics inside the tilted bracket,
- Accommodation of damper on the CMG
- Suppression of wiring



CMG 4-6S integrating electronics, mounting bracket and damper

CMG 15-45S principle

A high-performance product optimized for agile mini satellites

CMGs have been known for decades, but used to be considered difficult to operate owing to singularities during satellite manoeuvres (except by over-sizing the momentum capacity). Recent developments in guidance algorithms to suppress singularities now means that the full capacity of the CMG cluster can be exploited, minimizing the momentum demand for each CMG. With four CMGs of only 4 Nms, it is now possible to set a satellite in the 400kg class at more than three degrees per second in less than two seconds. Such a low momentum demand offers many advantages compared to a conventional over sized solution: the equipment is more compact and performances are improved.

A product based on proven technologies

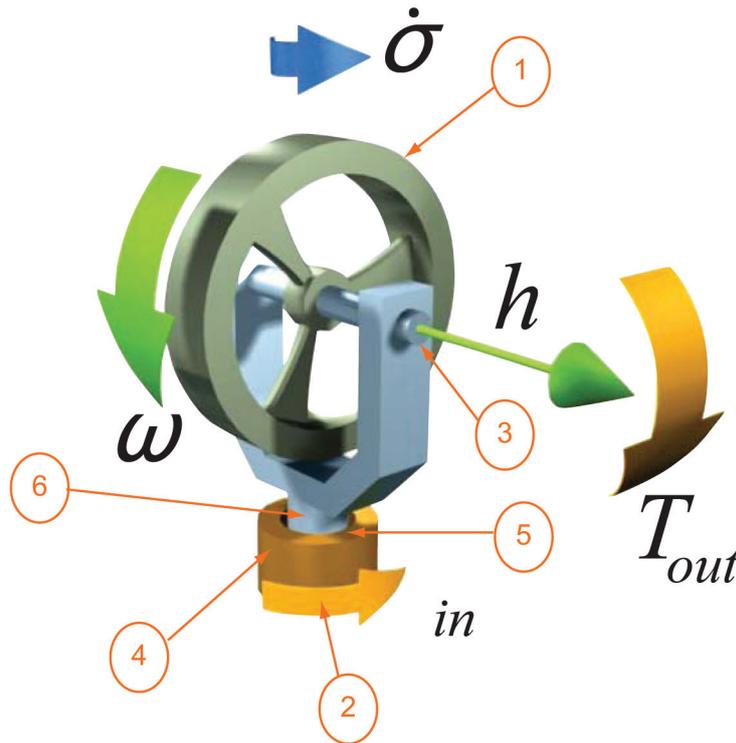
The equipment with its electronics have been designed for series production to minimize recurring costs. The

wheel is based on Teldix core technologies and the gimbal mechanism uses standard components from European manufacturers qualified by CNES and ESA. The electronics are based on an ASIC running at high frequency and a MIL 1553 data bus interface. All the technologies used are strongly derived from the qualified and flight proven CMG 15-45S.

A compact product with simple interfaces

The components are assembled in an optimized architecture that minimizes the volume and the mass. The CMG can be mounted on a single base plate with a minimal footprint and no additional hardware is required to install the equipment. The CMG 4-6S integrates easily into small satellites of 400kg or even less.

A step forward has been passed on the CMG 4-6S with the integration of additional function (electronics, mounting bracket, damper), allowing for a maximum compactness.



The kinetic momentum is fulfilled by the wheel (1) at constant speed. The precession of the wheel is fulfilled by the gimbal motor (2). The output loads are supported by the ball bearing of the wheel (3) and of the gimbal (4). An angular encoder allows the measurement of the gimbal position (5). The signals and power are led to the wheel through sliprings (6).

$$\vec{T}_{out}(t) = \vec{h}_{wheel} \wedge \vec{\dot{\sigma}}_{gimbal}$$