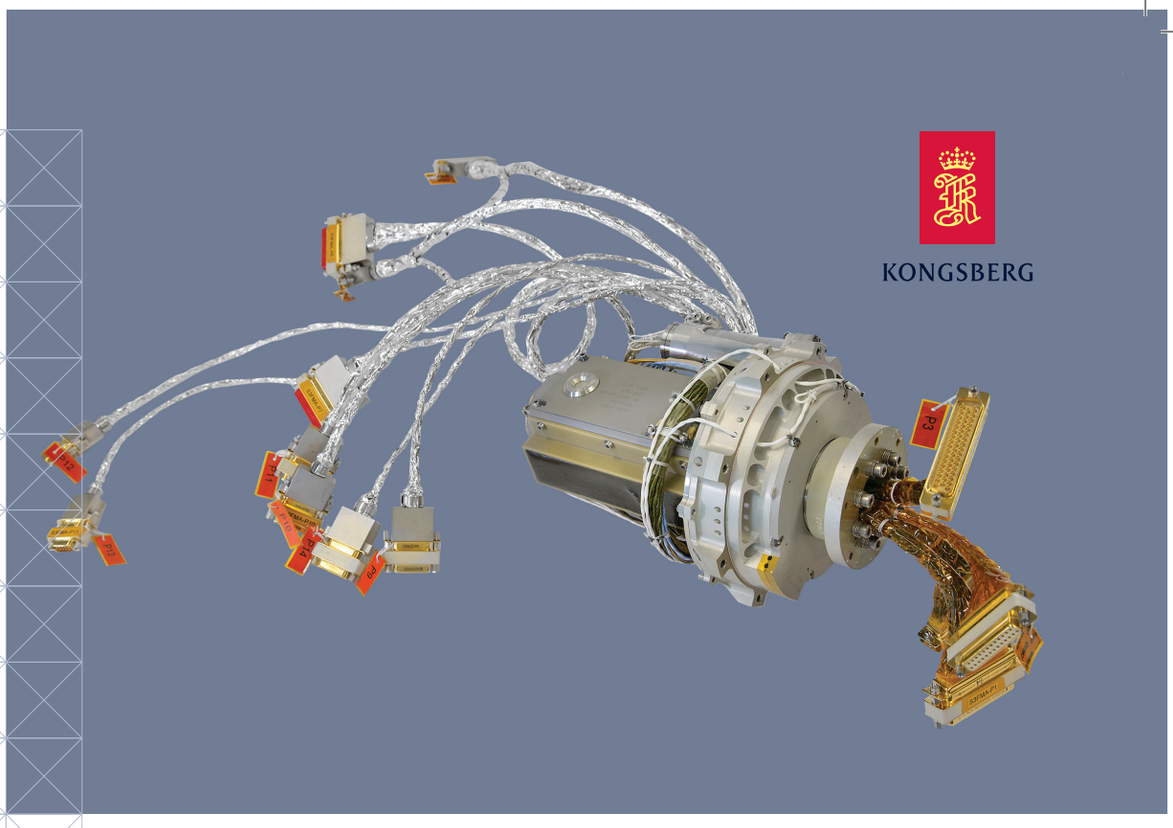
KARMA-4 SG



KONGSBERG KARMA-4 SG

KARMA-4 SG Solar Array Drive Mechanism

FEATURES

General

- Long life
- Low mass
- Handles different power transfer units
- Accurate position feedback

Slip-ring configuration

- Continuous rotation
- High power capability

Twist-capsule configuration

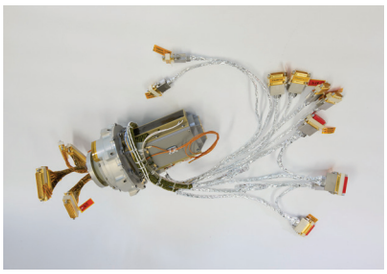
- ±177.5° rotation
- Flexible end stop location
- Optional end stop proximity feedback

The KARMA-4 SG (Kongsberg Adaptive Rotational Mechanism Assembly) is Kongsberg Second Generation SADMs with extensive heritage on LEO and science satellites.
KARMA-4 SADM is a modular configurable design that consists of two main sub-systems; the driveline with motor/gear including support structure to interface and react forces to S/C and the rotary solar power and signal transfer unit.
The power and signal transfer can be accomplished either using a flex Twist Capsule for limited rotation or a Slip Ring for continuous rotation applications. The KARMA-4 SG configurability is achieved with a standardised interface to the power transfer unit.

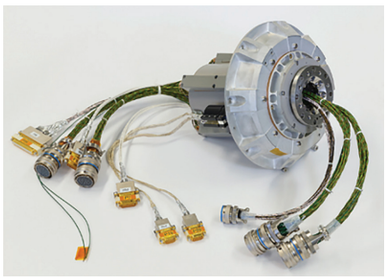
The KARMA-4 SADM complies to requirements by virtue of 4 main functions:

1. Retain solar array and react forces during launch and in orbit manoeuvres
2. Rotate the S/A in desired direction and position in orbit by stepper motor commutation power
3. Transfer power and signals from S/A rotating reference frame to S/C stationary reference frame
4. Position and temperature telemetry

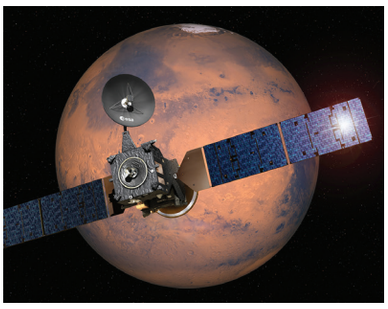
The twist-capsule provides a lighter and noise free system, but with limited rotation range and power transfer.
Both slipring and twist-capsule are designed for more than 100.000 accumulated revs.



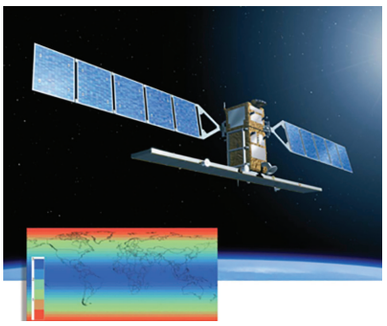
KARMA-4 SADM with slip ring used on Sentinel-3 and ExoMars



KARMA-4 SADM with Twist-Capsule on Sentinel-1 and SolarOrbiter



The first mission of the ExoMars programme includes the Schiaparelli lander and the ExoMars Trace Gas Orbiter in a circular 400-km altitude orbit conducting its scientific mission.



SENTINEL-1

KARMA-4 SG is currently flying on 5 satellites, i.e. Sentinel-1 A/B, Sentinel-3 A/B, and ExoMars, and has been contracted to another 5 satellites.

KARMA-4SG TECHNICAL DATA

Mechanism	
Motor type	Redundant two phase bipolar stepper
Rotational speed capability	2 °/s
Full step resolution	0.0136 °
Qualification operational life	7.5 years
Qualification revolutions	85000 of output shaft
Power requirements	Typically 3 W
Position feedback	Potentiometer
Slip-ring capacity	
Power tracks	36 tracks rated at 5 A, AWG20 wires
Signal tracks	20 tracks rated at 1 A, AWG 26 wires
Ground tracks	4
Total current transfer	90A
Twist-Capsule capacity	
Power tracks	52 tracks rated at 5 A, AWG18 wires
Signal tracks	48 tracks rated at 50 mA, AWG 26 wires
Ground tracks	8
Total current	90 A
Qualification temperatures	
NNon-operational	-50 °C to +85 °C
Operational	-30 °C to +85°C
Mass	
Depending on configuration	3.8 kg to 4.7kg
Qualification loads	
Axial	1800 N
Radial	2000 N
Cross axis moment	320 Nm
Dimensions	
Length	240 mm (200 mm from interface plane)
Diameter	150 mm

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