

# KONGSBERG Adaptive Rotational Mechanism Assembly (KARMA-4)

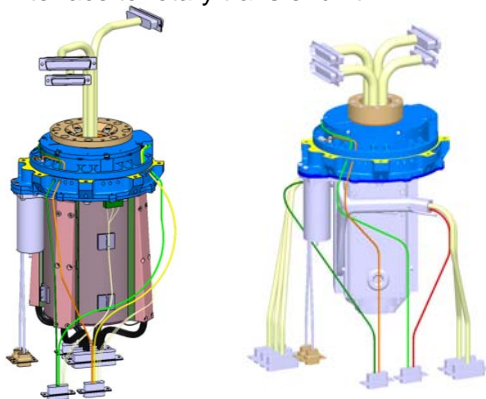


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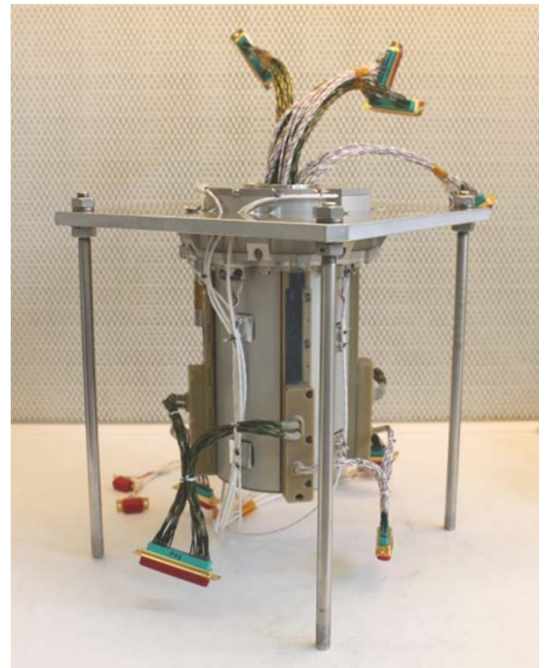
The Kongsberg Adaptive Rotational Mechanism Assembly (KARMA-4) is the latest incarnation of a SADM, with a long line of heritage.

The KARMA-4 consists of two main components; the driveline containing all torque generating components and structure to interface and react forces to S/C, and a rotary power and signal transfer unit.

The rotary power and signal transfer can be accomplished through either a twist-capsule or a slip-ring, depending on functional requirements. The KARMA-4 basic mechanism is designed for both these configurations, and maintains a common interface to rotary transfer unit.



*KARMA-4 with twist capsule  
and slip ring*



## Features

### General

- High reliability
- Long life
- Low mass
- European components
- High load capacity
- Handles different transfer requirements
- Accurate position feedback

### Slip-ring configuration

- Continuous rotation
- High power capability

### Twist-capsule configuration

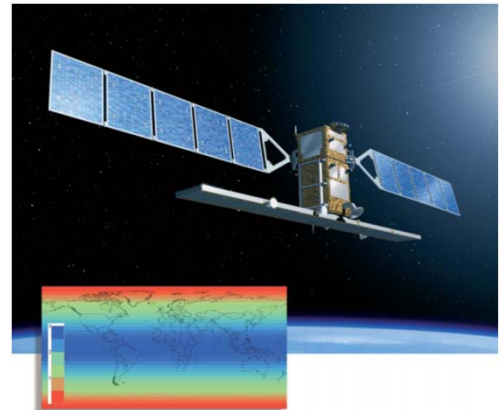
- $\pm 177.5^\circ$  rotation
- Flexible end stop location
- Optional end stop proximity feedback

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

1. Retain solar array; keep S/A attached to the S/C and react forces resulting from in orbit manoeuvre or launch
2. Point the S/A in desired direction
3. Transfer power and signals from S/A rotating reference frame, to S/C stationary reference frame
4. Redundant position feedback

Sentinel-1 is one element in the GMES (Global Monitoring for Environment and Security) programme, an initiative by the European Commission and ESA to set up a sustainable European network for recording and analysing environmental data. Sentinel-1 will help to monitor and analyse environmental events round the globe.

Sentinel-1 data will benefit numerous services. For example, services that relate to the monitoring of Arctic sea-ice extent, routine sea-ice mapping, surveillance of the marine environment including oil-spill monitoring and ship detection for maritime security, monitoring land-surface motion risks, mapping of land surface for forest, water and soil management and mapping in support of humanitarian aid and crisis situations.



<b>KARMA-4 Technical Data</b>	
<b>Mechanism</b>	
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 or optical encoder
<b>Typical Slip-ring performance</b>	
Power tracks	36 AWG20
Signal tracks	20 / 1 A
Ground tracks	4
Total current	90 A
<b>Typical Twist-capsule performance</b>	
Power tracks	52 AWG18
Signal tracks	48 / 50 mA
Ground tracks	8
Total current	90 A
<b>Qualification temperatures</b>	
Non-operational	-50 °C to +85 °C
Operational	-30 °C to +85 °C
<b>Mass</b>	
Depending on configuration	3.8 kg to 4.7 kg
<b>Qualification loads</b>	
Axial	1800 N
Radial	2000 N
Cross axis moment	320 Nm
<b>Dimensions</b>	
Length	240 mm (200 mm from interface plane)
Diameter	150 mm