

# REACTION WHEEL

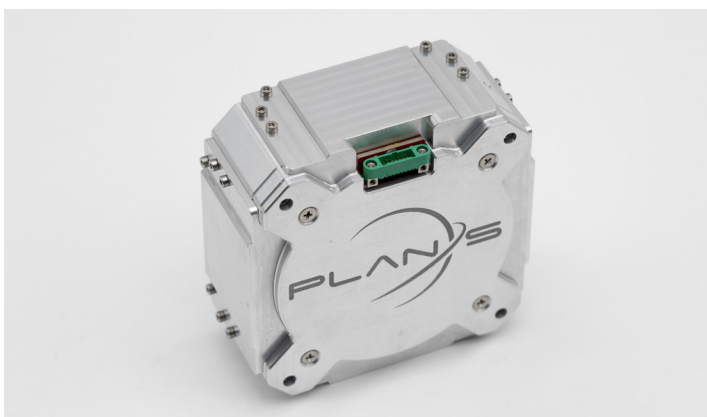
## PS-RW-500

### High Momentum. Zero Cogging. Built for Stability.

Reaction Wheel-500 delivers high-momentum, low-disturbance attitude control for 50-200 kg class satellites, combining a slotless PMSM, hybrid ceramic bearings, and proven control architecture.

#### KEY HIGHLIGHTS

- ▶ 516mN·m·s rated momentum and 50mN·m peak torque for high-agility maneuvers.
- ▶ Frameless slotless PMSM with zero cogging torque for smooth, low-disturbance operation.
- ▶ ABEC-7 hybrid ceramic bearings for low friction and long life in vacuum environments.
- ▶ Sensored field-oriented control (FOC) with minimal torque ripple.
- ▶ Optional wire-rope vibration isolator (typical natural frequency 45-60 Hz, tunable on request with engineering support).
- ▶ In-orbit automatic encoder calibration mode for sustained accuracy.
- ▶ **Multi-mode operation:** Speed, momentum, acceleration, and torque control.
- ▶ Regenerative braking returns deceleration energy back to the satellite bus.
- ▶ Full protection suite: over-temperature, over-current, under/over-voltage.



**Reaction Wheel-500 provides the reliability and control accuracy required for advanced satellite missions.**

#### TECHNICAL FEATURES

##### Performance

Rated Momentum	516 mN·m·s
Maximum Torque	50 mN·m
Maximum Speed	6512 rpm
Speed-Control Accuracy ( $2\sigma$ )	< 0.4 rpm
Static Imbalance	< 15 mg·cm
Dynamic Imbalance	< 30 mg·cm <sup>2</sup>
Balance Grade @ 1000 rpm (ISO-21940-11)	G 0.2

##### Hardware

Operating Voltage	12 - 32 V
Dimensions (L × W × H, with cover)	96 × 96 × 41.5 mm
Total Mass	1095 g
Rotor Inertia	7569 g·cm <sup>2</sup>
Communication Interfaces	2× CAN, UART/RS485
Mounting	Optional wire-rope isolator (typ. 45-60 Hz, tunable)

##### Environmental

Operating Temperature	-25 / +60 °C
Storage Temperature	-40 / +80 °C
Random Vibration	14.1 (GEVS) gRMS
Radiation Tolerance	> 28 kRad
Designed Lifetime	> 5 years

##### Power

Avg. Power @ 0 rpm	0.5 W
Avg. Power @ 2000 rpm	1.3 W
Avg. Power @ Max Speed	6.5 W
Peak Power	38 W

## MISSION BENEFITS

**Smooth, Low-Disturbance Pointing:** Slotless motor design eliminates cogging torque; hybrid ceramic bearings minimize friction-induced disturbance.

**High Pointing Stability:** Speed-control accuracy below 0.4 rpm ( $2\sigma$ ); ISO-21940-11 G0.2 balance grade after vibration.

**Vacuum-Ready Longevity:** Hybrid ceramic high-precision bearings tuned for low friction & long life in vacuum conditions.

**Mission-Tunable Mounting:** Optional wire-ropes isolator with natural frequency tunable to payload requirements (typ. 45-60 Hz); engineering support provided for selection and integration.

**Fully Qualified:** Environmental qualification complete; first launch scheduled October 2026.

## HERITAGE / QUALIFICATION

**Status:** Fully qualified; environmental qualification campaign complete.

**TRL:** 8.

**First Flight:** Scheduled October 2026.

**Acceptance Testing:** Each wheel acceptance-tested and individually balanced.

**Micro-Vibration Characterization:** Six-axis Kistler force-moment dynamometer; data available on request.

**Mounting Option:** Wire-ropes isolator with natural frequency tunable to mission requirements (typ. 45-60 Hz); engineering support available for selection and integration.

## STANDARDS & COMPLIANCE

- ▶ NASA-GEVS (GSFC-STD-7000) environmental verification.
- ▶ SpaceX Rideshare Payload User's Guide (Version 10, September 2024) launch-environment compatibility.

