GEN2

ADCS ACTUATORS

Our Gen 2 actuators are the next step towards a complete, unified ADCS solution for all sizes of satellites. It builds on the successes of Gen 1 and refines the most important aspects. The architecture behind the Gen 2 components allows for full scalability in size, unlocking the potential to apply our ADCS systems for much larger satellites.
The new architecture ushers in better connectivity, more mechanically robust designs, and full in-orbit reprogramability.



CubeWheel

Robust, high-efficiency reaction wheels

CubeWheels are built using high-precision, high-load bearings with state-of-the-art space-rated lubrication. Despite its robust nature, each wheel is balanced to perfection to enable high precision and stability ADCS systems. Integrated into each wheel is a radiation tolerant electronic drive circuit, which makes controlling it extremely simple. The ease of use, together with the robust design, makes CubeWheel the perfect reaction wheel for satellites with strict requirements on reliability.



CubeTorquer

Ultra-low remanence magnetic torquers

Each of our torquers are built using a heat-treated ferrous core, which delivers ultra-low magnetic remanence and high linearity. Our torquers are built using automated machinery and goes through rigorous testing, which ensures absolute repeatability, and enables high volumes and low cost. With their compact design, and low-profile connector, they are perfectly suited for satellites where space and mass are of high priority.

www.cubespace.co.za

PRODUCT INFORMATION

CubeWheel

*** Preliminary specifications.**

Performance	CW0017	CW0057	CW0162	CW0500*	CW1200*	CW2500*	CW5000*
Nominal Motor Supply Voltage	8	12	12	12	16	24	24
Max Speed [RPM]	10000	10000	10000	10000	10000	10000	10000
Momentum @ 6000 RPM [mNms]	1.77	5.7	16.2	50	120	250	500
Saturation Torque @ 6000 RPM [mNm]	0.23	2	7	16	20	27	37
Dynamic Imbalance [g.cm²]	<0.005	<0.014	<0.014	<0.05	<0.05	<0.05	<0.05
Physical							
Mass [g]	60	115	144	310	450	750	970
Dimensions [WxLxH] [mm]	28x28x26	35x35x24	46x46x24	66x66x25	72x72x31	86x86x36	100x100x37
Power & Data							
Data Bus**	CAN/UART/RS-485 **I2C available for custom solutions						
Connector	Molex Micro-Lock Plus				Harwin Gecko SL		
Digital Supply Voltage [V]	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Motor Supply Voltage Range [V]	6.4-16.8	6.4-16.8	6.4-16.8	6.4-16.8	6.4-16.8	16-36	16-36
Average Power [2000 rpm] [mW] (Includes digital power)	180	336	336	~800	1100	2700	2700
Average Power 6000 rpm] [mW] (Includes digital power)	300	770	770	5300	4700	9000	9000
Peak Power [Max Torque @ 6000 rpm] [W] (Includes digital power)	0.85	2.7	7.2	~15	13	30	48
Qualification Level							
Radiation [kRad]	24						
Random Vibration [g RMS]	14.16 (NASA GEVS)						
Thermal vacuum [°C]	-20 to 80						
Thermal cold and hot start [°C]	-35 to 70						

CubeTorquer

Performance	CR0002	CR0003	CR0004	CR0006	CR0008	CR0010	CR0012	CR0020
Max Voltage [V]	5							
Minimum Magnetic Moment [Am²] @ 5V	0.20	0.30	0.40	0.60	0.80	1.00	1.20	2.00
Magnetic Gain [Am²/A]	2.3	4.3	3.3	5.8	7.0	7.8	8.6	13.2
Linearity [0-5V]	2.50 %							
Nominal Resistance [Ω]	51.0	66.5	39.5	45.0	44.5	37.5	36.5	32.5
Physical								
Mass [g]	16.5	23	23	31	28	37	45	54
Dimensions [WxLxH] [mm]	10.5x47x10.5	10.5x59x10.5	10.5x59x10.5	10.5x77x10.5	10.5x92x10.5	10.5x92x10.5	13x122x13	13x152x13
Power & Data								
Connector	Molex Pico-Lock							
Qualification Level								
Radiation [kRad]	N/A							
Random Vibration [g RMS]	14.16 (NASA GEVS)							
Thermal vacuum [°C]	-20 to 80							
Thermal cold and hot start [°C]	-35 to 70							

KEY FEATURES

CubeTorquer



COMPACT DESIGN | >95% HIGH LINEARITY | LOW PROFILE CONNECTOR | LOW REMANENCE

2U - 27U

CubeWheel



14.16g RMS | LOW IMBALANCE | INTERNAL MAGNETIC SHIELDING

INFLIGHT REPROGRAMABILITY | -20°C - 80°C EXTENDED TEMPERATURE RANGE | 5 YEARS LONG DESIGN LIFETIME

WHEEL CONFIGURATION

Depending on the application, a satellite may benefit from either 3 wheels mounted orthogonally or 4 in a pyramid configuration.

CONFIGURATION	DESCRIPTION	TYPICAL USE CASE
3-Wheel	Three orthogonal reaction wheels are used to enable full 3-axis control.	Nadir, sun and inertial pointing.
4-Wheel	Four reaction wheels are mounted in a pyramid configuration to enable 3-Axis control, while providing redundancy for the loss of any one wheel. Wheels are biased to an offset speed to avoid zero crossings	Target tracking and fast slew manoeuvres.



3-Wheel configuration



4-Wheel configuration

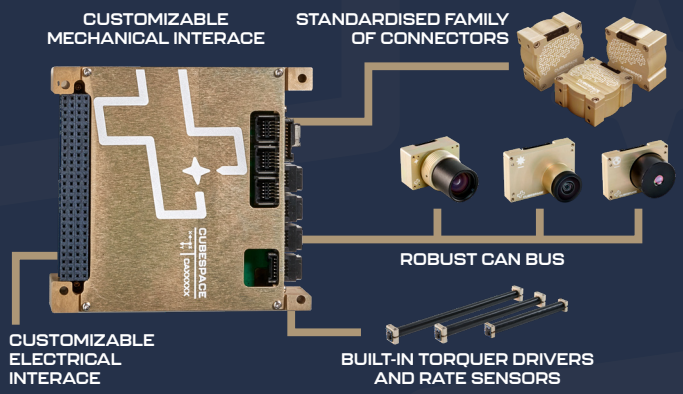
ACTUATOR SIZING

SATELLITE SIZE	CUBEWHEEL	CUBETORQUER
2U (2 kg)	3x CW0017	CR0002
3U (4 kg)	3x CW0057 / 4x CW0017	CR0002 / CR0003
6U (10 kg)	3x CW0162 / 4x CW0057	CR0004 / CR0008
12U (20 kg)	3x CW0500 / 4x CW0162	CR0012
27U (50 kg)	3x CW1200 / 4x CW0500	CR0020

These are typical configurations. Each satellite and mission are different. Please contact us if you need support to size and select your actuators.

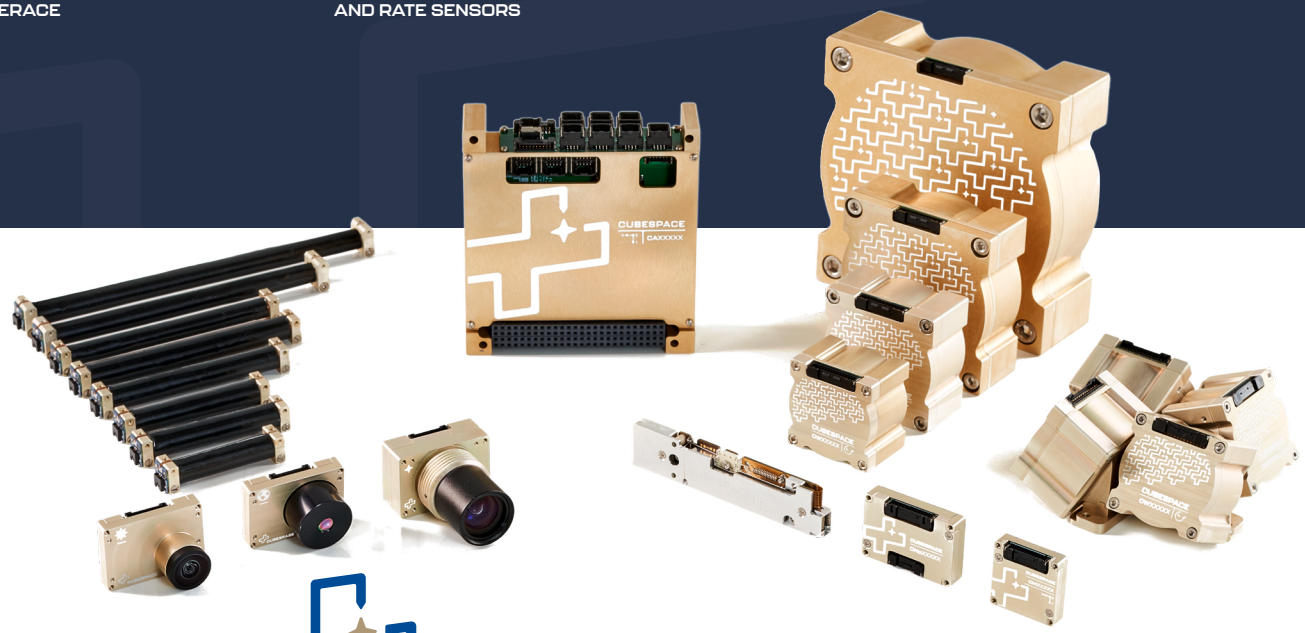
UPGRADE TO A TURN-KEY ADCS

Our integrated ADCS solutions combine our radiation tolerant computer, our flight-proven control system algorithms, our robust fault-detection and correction software, our comprehensive data and event logging mechanisms, with any selection of our sensors and actuators, with the option of also integrating third party components. We also assist with mission analysis and commissioning, effectively being your outsourced ADCS team.



ADCS COMPUTER

- Simple API for interface to main OBC
- Bootloader with in-orbit reprogramability for all parts of the ADCS
- Non-volatile memory for permanent storage
- Firmware images for each component
- TLM and event logging and monitoring
- Sensor mounting configuration and calibration
- Range of estimators and controllers
- Synchronization of ADCS components (including PPS input)
- Power monitoring, regulation, and switching
- Fault detection, isolation and recovery (FDIR) mechanisms



CUBESPACE

CubeSpace is an aerospace company that specializes in small satellite Attitude Determination and Control Systems (ADCS). We offer modular, low-power ADCS components with class-leading performance. Our components are designed to be compatible with almost all commercially available CubeSat suppliers.

We support each customer to evaluate their ADCS needs, choose the correct hardware solution, and tailor this solution to correctly integrate into their satellite.

Our service is personalized, and we strive to help customers find the balance between powerful ADCS performance and reliable operations.

Our 480m² facility is equipped with state-of-the-art equipment such as 160m² clean room space with an 8-meter-long dark optics calibration room, humidity controlled thermal chamber, Helmholtz coil, a 75m² test facilities with a 900 mm x 1300mm thermal vacuum chamber, 8kN vibration shaker, auto-winding machine, wheel balancing machine, and high accuracy 3-axis rotation stages.

The CubeSpace team consists of highly qualified aerospace technicians with IPC class 3 training, and engineers specializing in control system research and development. Our company has delivered more than 2400 ADCS components to 150 clients for approximately 250 satellites.

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