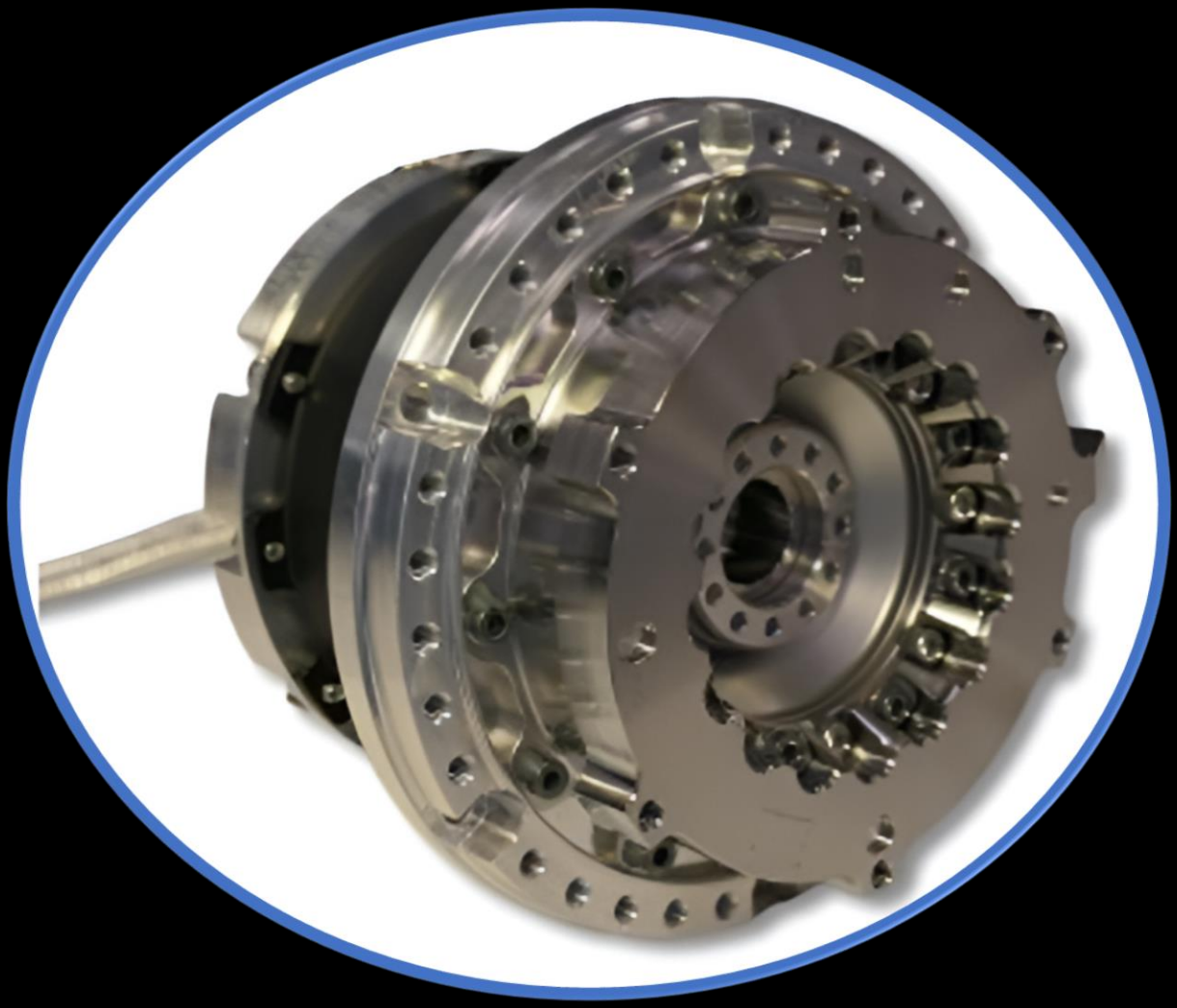
beyond gravity

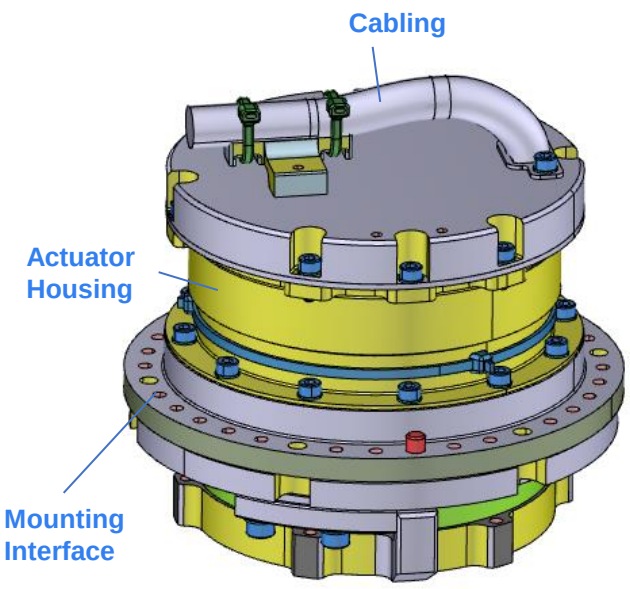


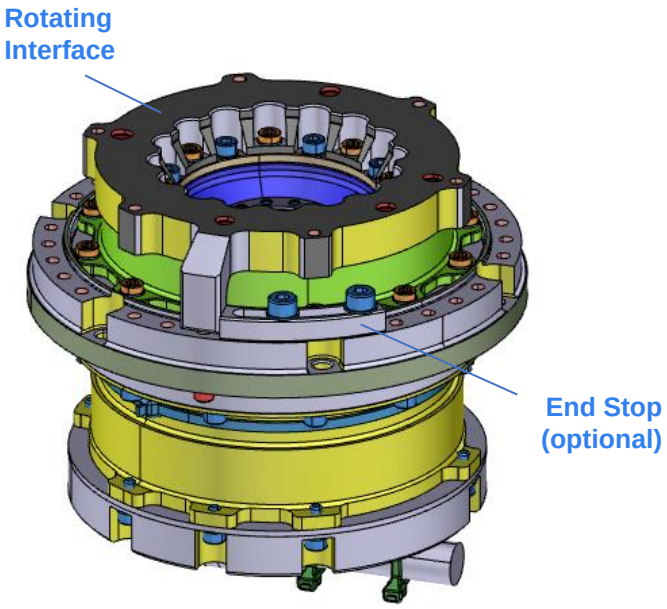
SARA21

General Purpose Rotary Actuator
Precise, Compact, Powerful.

Beyond Gravity offers a general-purpose rotary actuator with 100+ units successfully flying. SARA21 is affordable, compact, powerful and robust, and can be used for many applications.

Scalable High Power SADM for all missions





Huge Heritage, Proven Design

- More than 110 SARA21 in space, first flight 2005
- Qualified in various qualification campaigns
- In continuous production for 20 years, very stable supply chain
- Production capacity up to 50 units per year

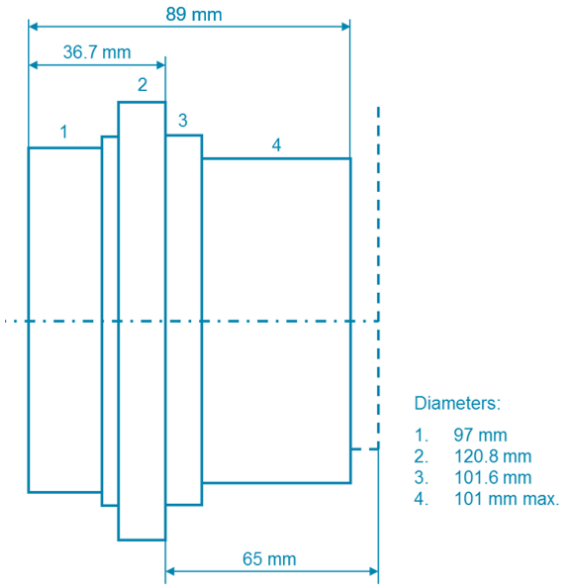
Flexible and Robust

- Typically used in antenna pointing, but other applications are possible
- High torque capacity, safely back-drivable
- Simple stepper motor interface

Tailored for you

- Huge engineering expertise allowing adaptation for unusual and specific applications
- Adapted interfaces, test scope, modifications, are feasible on request.

Envelope Drawing



A detailed interface drawing can be provided on request.

Contact us: Beyond Gravity Schweiz AG | Stefan Wismer, Sales Manager | stefan.wismer@beyondgravity.com

Operational Performance		
Drive direction	Continuous rotation in forward and reverse direction	
Output speed range (nominal in orbit)	0 to 1 rev / 12 min	
Max. output speed (ground testing)	0.5 °/s	
Harmonic drive reduction ratio	160:1	
Output Step Size (full step)	0.00625°	
Qualified Lifespan	15 years in orbit (+ 5 years storage with 2 years integrated on satellite)	
Revolutions performance	500 full revs or 125000 fine pointings (± 0.5°)	
Mechanism accuracy	± 0,01°	
Stepper motor characteristics		
Coil Resistance @ 20°C	76 Ω ± 10%	
Coil Inductance @ 20°C	156.0 mH ± 20%	
Number of steps per revolution of motor	360	
Stable positions (motor unpowered)	360	
Unpowered holding torque	≥ 7 Nm (without optional detent break)	
Powered Holding Torque @ 23.4V	≥ 30 Nm	
Nominal torque	≥ 25 Nm	
Position Measurement (coarse – output shaft)		
Position Output availability	0° … 356.5°	
Max. Dead Band	< 3.5°	
Resolution	28 Ω/°	
Linearity	± 0.1%	
Positioning accuracy	± 0.4°	
End-to-End Resistance	10 kΩ ±10%	
Operating Voltage	5V ± 10%	
Position Measurement (fine – motor shaft)		
Position Output availability	0° … 2.25° (x160)	
Max. Dead Band	< 0.022° (x160)	
Resolution	4488 Ω/°	
Linearity	± 0.1%	
Positioning accuracy (main vs. red.)	180° ± 0.4°	
End-to-End Resistance	10 kΩ ±10%	
Operating Voltage	5V ± 10%	
Mechanical properties		
External diameter	120 mm	
Total length	89 mm	
External cable length	0.5 m	
Mass (w/ external cable, w/o connector)	≤ 2.0 kg	
Power consumption		
	Vbus	*Total power*
Maximum conditions	23.4 V – 28,6 V	≤ 17 W
Connector		
D-SUB connector	DCMA37P	

Temperature specification

	Tmin	*Tambient*	*Tmax*
Ground storage	+ 10°C	+ 22°C	+ 40°C
In orbit non-operational	- 100°C		+ 100°C
Cold start-up limit	- 65°C		
In orbit operational	- 50°C	+ 22°C	+ 85°C

Static Loads

	Case 1	*Case 2*
Axial Load (F_z)	10'000 N	0 N
Radial Load (F_{xy})	0 N	8'000 N
Bending Moment (M_{xy})	0 Nm	200 Nm

Stiffnesses

Axial stiffness (K_z)	≥ 21*10^6 N/m
Shear stiffness (K_{xy})	≥ 35*10^6 N/m
Torsion angular stiffness ($K_{\theta z}$)	≥ 10000 Nm/rad
Bending angular stiffness ($K_{\theta xy}$)	≥ 50000 Nm/rad

Mechanical Qualification Levels

High level sine vibrations:	*Frequency (Hz)*	*⊥ MOUNTING PLANE*	*// MOUNTING PLANE*
	5-22	± 10.0 mm	± 10.0 mm
	22-100	20g	20g
Sweep rate	2 oct/min		
Random vibrations:	*Frequency (Hz)*	*⊥ MOUNTING PLANE*	*// MOUNTING PLANE*
	20-50	+ 6 dB/oct	+ 6 dB/oct
	50-210	1.500 g^2/Hz	1.500 g^2/Hz
	210-285	1.500 g^2/Hz	- 20 dB/oct
	285-290	1.500 g^2/Hz	- 95 dB/oct
	290-300	1.500 g^2/Hz	0.060 g^2/Hz
	300-400	0.300 g^2/Hz	0.060 g^2/Hz
	400-417	0.300 g^2/Hz	+ 95 dB/oct
	417-600	0.300 g^2/Hz	0.300 g^2/Hz
	600-690	- 30 dB/oct	0.300 g^2/Hz
	690-700	- 35 dB/oct	0.100 g^2/Hz
	700-800	0.030 g^2/Hz	0.100 g^2/Hz
	800-925	+ 45 dB/oct	0.100 g^2/Hz
	925-1200	0.100 g^2/Hz	0.100 g^2/Hz
	1200-2000	- 6 dB/oct	- 6 dB/oct
	Global	25.5 g_{rms}	22.4 g_{rms}

Shock levels for each axis (X, Y, Z):

	Frequency	**Shock input levels**
	500 Hz	200 g
	3000 Hz	2000 g
	10000 Hz	2000 g