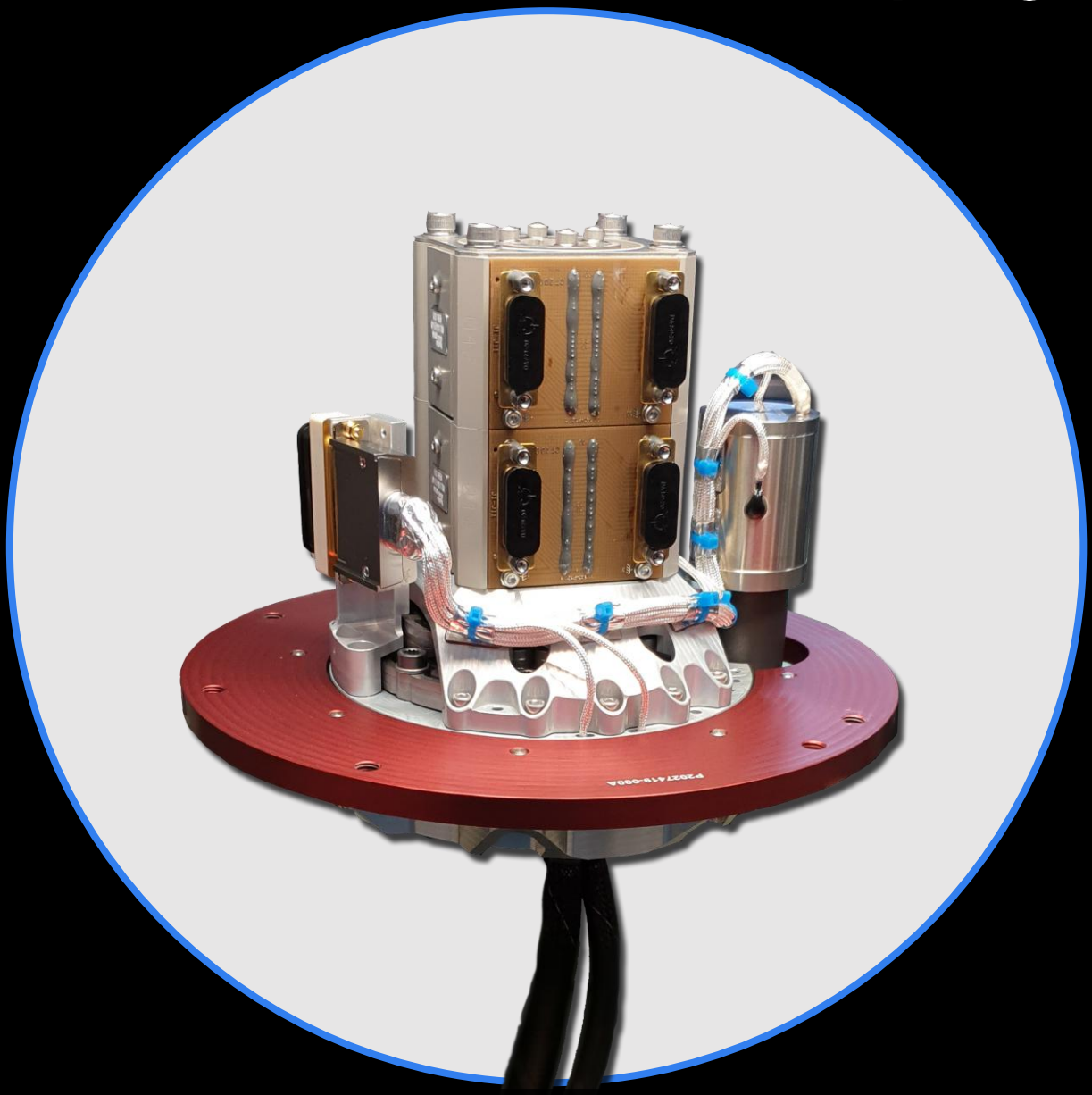
beyond gravity

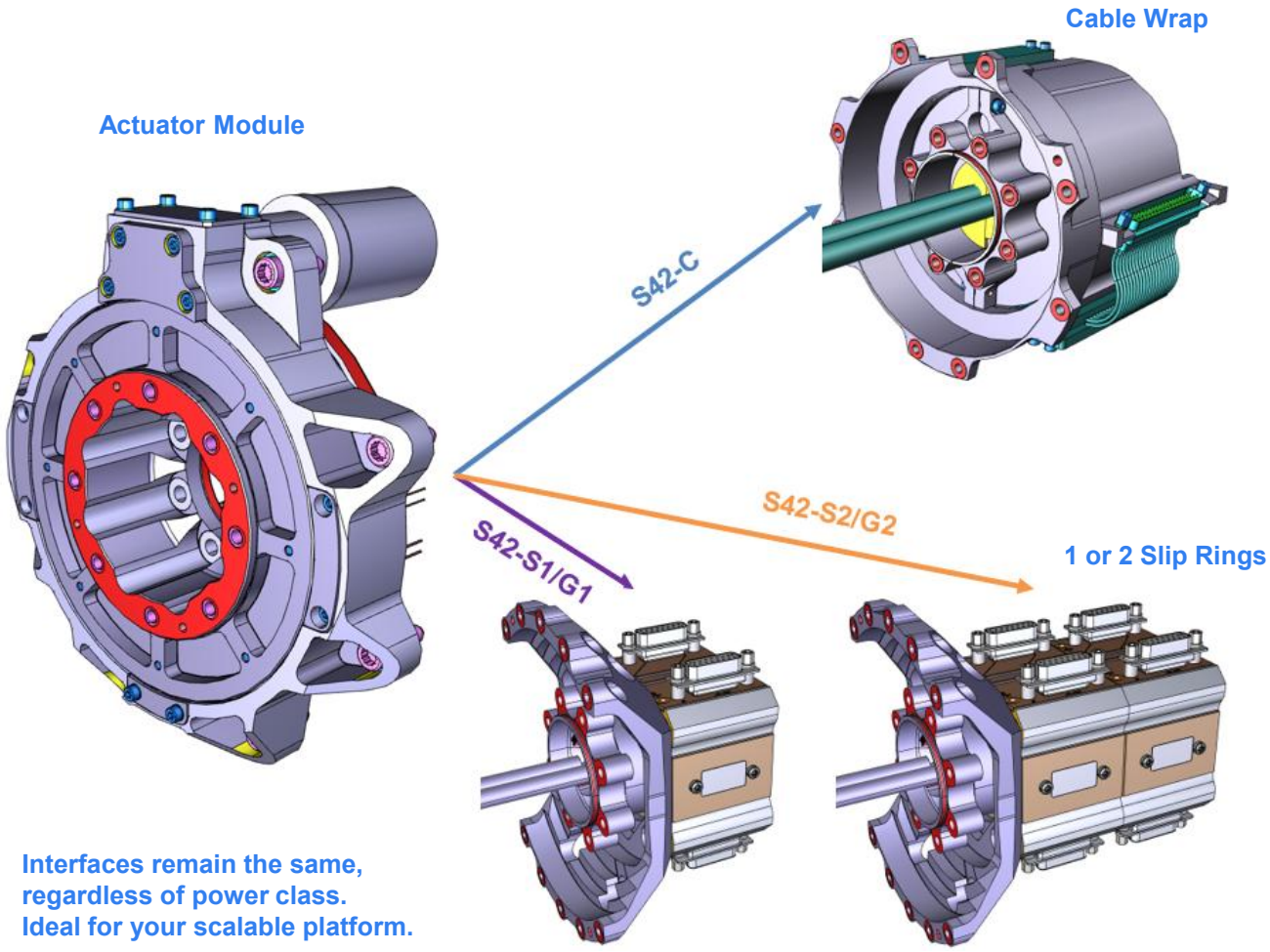


SEPTA42

Solar Array Drive Mechanism for Small Sats, Constellations and Everything

Beyond Gravity offers a modular family of Solar Array Drive Mechanisms to serve a large range of spacecraft. The SEPTA42 is available at attractive prices and lead times and can be produced in large quantities. More than 100 FMs have been produced already.

SEPTA42: Modular Constellation SADM



Interfaces remain the same, regardless of power class. Ideal for your scalable platform.

Modularity for lowest cost

- Family of SADM for a large range of missions
- Standard mechanical interfaces
- Standard actuator module for all types

Tailored for you

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

Robust and Proven

- Flight proven slip ring technology
- Standard actuator, enables industrial scale production
- Qualification Status:
  - TRL8 completed for all variants
  - TRL9 by projected launch end of 2025
- >100 FMs delivered to customers
- Proven combinations with drive electronics (SADE) available

High Cadence at short lead times

- New cleanroom for state-of-the-art assembly and testing
- Up to **18 Units per month**
- Rolling Stock for **lead times of 12 months**

Contact us: Beyond Gravity Schweiz AG | Nicolò Carletti, Sales Manager | nicolo.carletti@beyondgravity.com

SEPTA42: Modular Constellation SADM

	SEPTA42-C	SEPTA42-S	SEPTA42-G
Operational Performance			
Range of Motion	± 175°	Forward and reverse; multiturn (no “unwind” needed)	
Maximum output speed	1.0 °/s (depends on motorization requirements)		
Output Step Size (full step)	0.0074° [1)]		
Life Time	12 years		
Life Time Qualification Sequence	> 181’000 movements from -175° to +175°	> 133’000 full revolutions	> 58’000 full revolutions [1) 2)]
Delivered Torque			
Unpowered Holding Torque	> 1.4Nm [3)]	> 3Nm [1)]	
Powered Holding Torque	> 18Nm continuous (at 100mA constant current) [1)] > 25Nm continuous (”boost mode” - 130mA constant current) [1)]		
Powered Drive Torque	> 9.5Nm continuous (at 100mA constant current) [1)] > 12Nm continuous («boost mode» - 130mA constant current) [1)]		
Motor voltage	< 25.0V continuous, <70V peak		
Back-Drivability	Possible with unpowered motor		
Power & Signal Transfer			
Number of power lines (1 line = 1 forward & 1 return track)	36	-S1: 15 -S2: 30	-G1: 15 -G2: 30
Rated Power Capacity per Track	2.2 A_{RMS}	3.5 A_{RMS} [4)]	5.0 A_{RMS} [4)]
Voltage of power line	150V (as qualified)		
Connector-to-Connector Resistance, at 20°C	< 60 mΩ w/ 0.5m S/A harness	< 60 mΩ w/ 0.25m S/A harness	
Connector-to-Connector Resistance, at worst hot case	< 80 mΩ w/ 0.5m S/A harness	< 80 mΩ w/ 0.25m S/A harness	
Insulation	≥ 100 MΩ @ 500 V, 30s		
Noise (per line)	≤ 10 mV_{RMS}/A	≤ 20 mV_{RMS}/A	
Total Power Transfer	<11.9 kW	-S1: <7.8kW -S2: <15.6kW	-G1: <11.2kW -G2: <22.4kW
Position Measurement			
Position Output	Redundant reference position switch at two different locations (e.g. +90° and −90°)		

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Notes:

1) *Data provided in this datasheet is for standard 1:36 gearbox, but 1:50 gearbox is fully qualified and results in proportionally smaller step size / speed and increased torque capability.*
2) *Performance as qualified for a customer on S42-G, but same or better capability as S42-S expected to be feasible given that actuator module is identical*
3) *Lower unpowered holding torque is due to cable wrap spring-effect, and varies with position between 1.4Nm… 2.4Nm.*
4) *S42-S slipring is qualified to 3.5A per track on S42-S, and to 4.0A on SR-level and in other programs. The S42-G slip ring is qualified to 5.0A (functional) and 4.54A (life test) on S42-G, and to 6.0A per track in other programs.*

Motor Characteristics			
Coil Resistance @ 20°C	123 Ω ± 5%		
Mechanical Dimensions & Mass	**SEPTA42-C**	**SEPTA42-S**	**SEPTA42-G**
Max. Outer Diameter mounting flange	191 mm		
Length from front of flange	125 mm	-S1: 108.2 mm -S2: 158.0mm	-G1: 119.5mm -G2: 179.5mm
Length Overall	159 mm	-S1: 141.4 mm -S2: 191.4mm	-G1: 152.9mm -G2: 212.9mm
Mass (excl. margin & customer-specific harness)	4.9 kg	-S1: 4.5 kg -S2: 5.2kg	-G1: 4.7kg -G2: 5.4kg
S/C Interface	8 through holes for M6 on a circle with D = 175mm		
S/A Interface	8 threaded holes M6 on a circle of D = 80mm		
Static Loads			
Axial Load	10’000 N		
Radial Load	10’000 N		
Bending Load	600 Nm		
Torsional Load	23.6 Nm (load bearing capability – backdriving may happen)		
Stiffnesses			
Axial stiffness (along y)	≥ 1.2×10^8 N/m		
Shear stiffness (along x, z)	≥ 8.0×10^7 N/m		
Torsion angular stiffness	≥ 7×10^3 Nm/rad		
Bending angular stiffness	≥ 8.6×10^4 Nm/rad		
First mode frequency with 2.5 kg @ 50mm from S/A interface	> 350 Hz	> 350 Hz	> 350 Hz

Mechanical Qualification Levels
Tested with 2.5kg dummy mass with CoG 50mm from the S/A IF plane. Other levels/masses possible on request.

High level sine vibrations:	Frequency (Hz)	S42-C	S42-S	S42-G
	0 – 22.6	±9.73 mm		±6.35mm [2]
	22.6 – 50.0	20g		13g [2]
	50.0 – 125	20g		10g [2]

Random vibrations:	// MOUNTING PLANE (x,y axes)		⊥ MOUNTING PLANE (z-axis)	
	Freq. (Hz)	Level	Freq. (Hz)	Level (g²/Hz)
	20 – 60	+6 dB / oct	20 – 60	+6 dB / oct
	60 – 500	0.4 g²/Hz	60 – 500	0.5 g²/Hz
	500 – 2000	-6 dB / oct	500 – 1395	-6 dB / oct
			1395 – 1450	-60dB / oct
			1450 – 2000	0.03 g²/Hz
Global:	18.3 g_{rms}		20.3 g_{rms}	

Shock levels for each axis (X, Y, Z):	**S42-C**	**S42-S**	**S42-G**
	100 Hz: 20g		100Hz: 55g
	1000 Hz: 500g		2500Hz: 2000g
	4000 Hz: 1865g		10000Hz: 2000g
	10000 Hz: 1865g		

Qualification Temperature Levels

	S/C conductive interface	**S/A conductive interface**	**S/C radiative interface**
Ground Storage	10°C … 30°C	10°C … 30°C	10°C … 30°C
Hot Non-Operational (Survival)	+ 90°C	+ 110°C	+ 90°C
Hot Operational	+ 70°C	+ 100°C	+ 70°C
Cold Operational	– 30°C	– 50°C	– 30°C
Cold start-up limit	– 40°C	– 70°C	– 40°C
Cold Non-Operational (Survival)	– 40°C	– 70°C	– 40°C
Reliability			
Reliability w.r.t. MIL-HDBK-217[5)]	>99.6%[5)]	>99.97%	>99.88%[6)]

Notes:

5) *Using very conservative assumption that SADM is already fully "failed" when only a single power/signal transfer is lost. In particular for S42-C, which assumes a single non-redundant wire per transfer, reliability is much higher (>99.9%) if simple wire cross-strapping or redundancy is employed.*

6) *Assumes standard S42-G harness with two SR wires per connector pin. For one SR wire per pin, reliability is equivalent to S42-S.*

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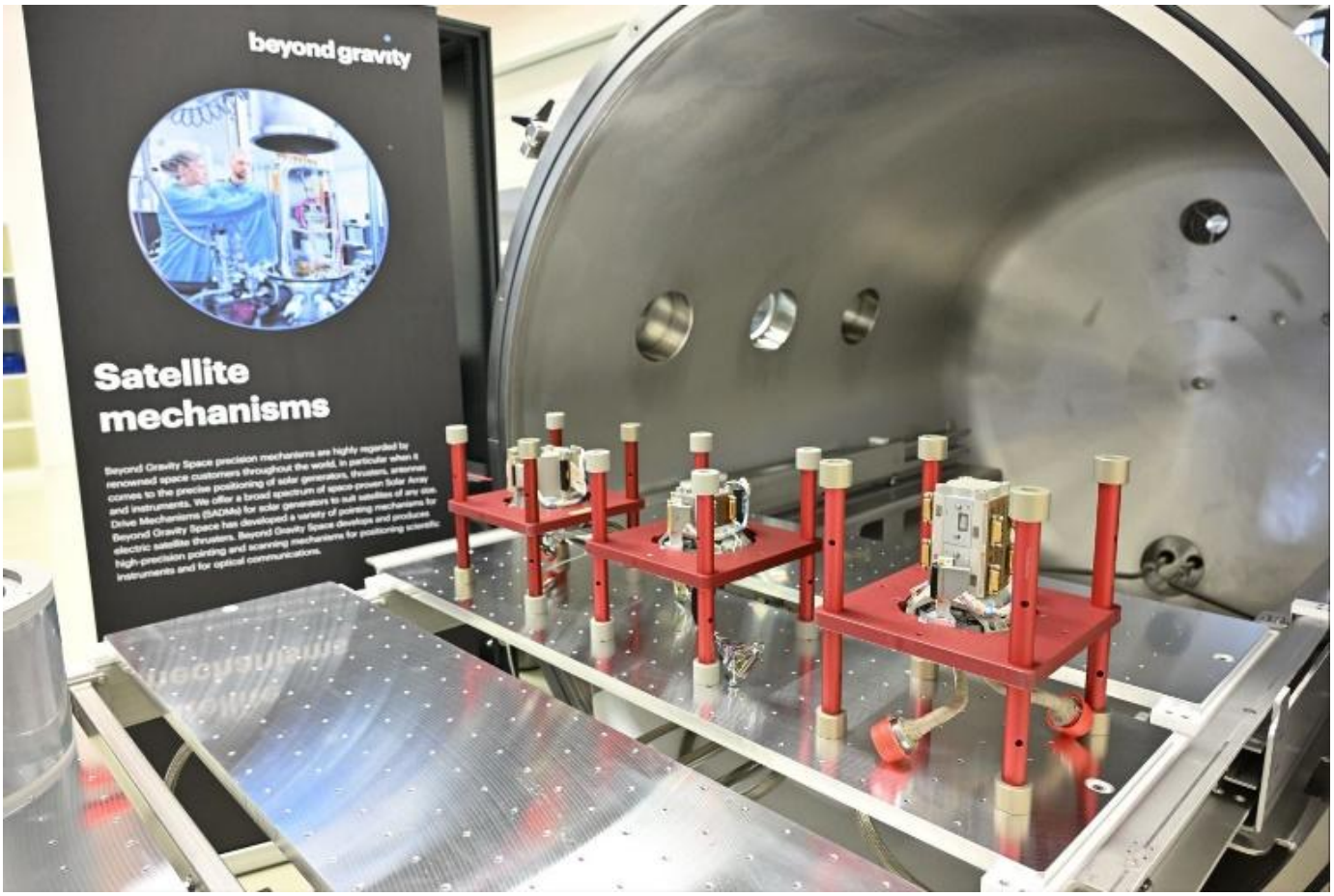

SEPTA42 family. Left: S42-C, Middle:S42-S1, Right: S42-G2).

Batch of 6x S42-C FMs ready for testing.