



APM

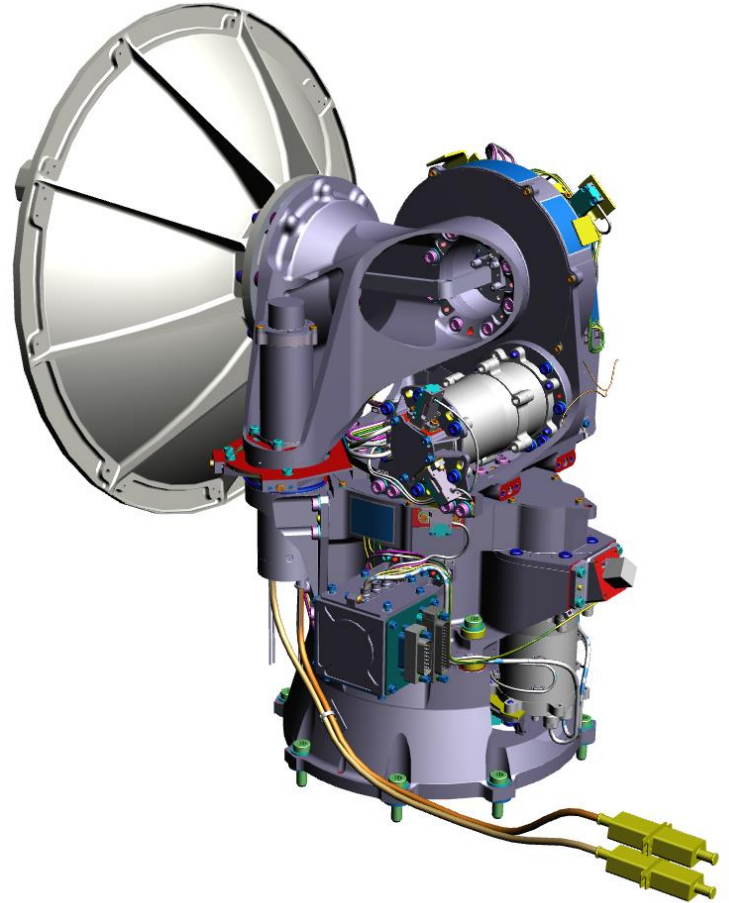
Tailorable Antenna Pointing Mechanism for all kind of RF communication in space

Beyond Gravity offers an Antenna Pointing Mechanism that can be widely tailored to mission needs

Tailorable Antenna Pointing Mechanism (APM)

Advantages of APM

- APMs for a large range of missions includes:
 - Azimuth and elevation axis with same parts
 - RF waveguide with rotary joints
 - Antenna
 - Hold Down and Release Mechanism (HDRM)
 - Azimuth axis with Twist Capsule > 8 Mio. cycles
- Large angle range for full hemisphere coverage
- Currently (02/2024) being qualified in 3 variants for 3 different missions



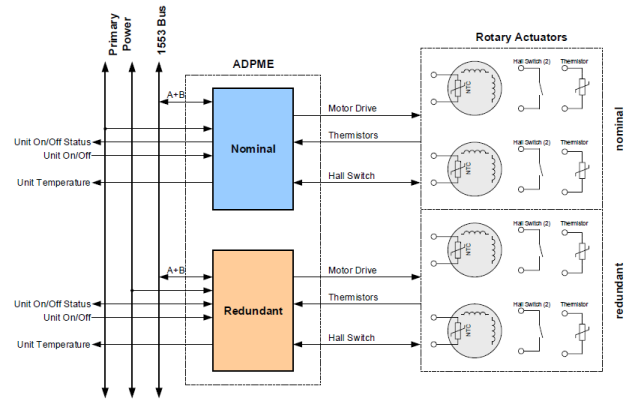
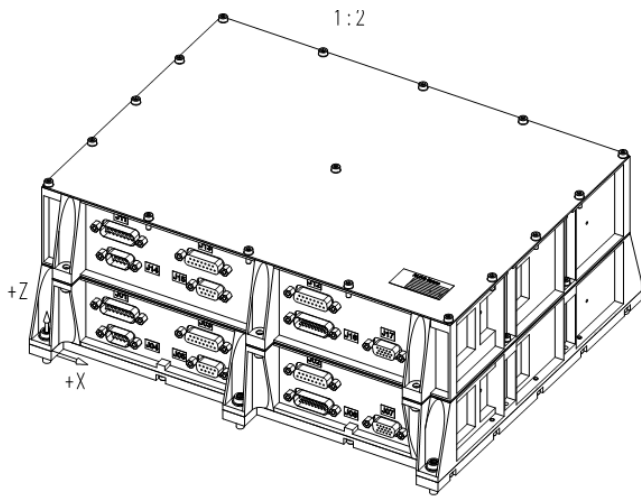
Tailored for you

- Various waveguides (Ka, X-band) and coaxial cable
- With or without HDRM
- Antenna tailorable to mission
- Accuracy and angular velocity tailorable to mission
- Optional control electronics

| | | APM | Options *** |
|--|-----------|--|--|
| Electromechanical characteristics | | | |
| Range of Motion | Azimuth | $\pm 200^\circ$ | |
| | Elevation | $\pm 100^\circ$ | |
| Step Size | Azimuth | 0.044° | |
| | Elevation | 0.044° | |
| Maximum output speed | Azimuth | 0 - $15^\circ/s$ | 0 – $70^\circ/s$ |
| | Elevation | 0 - $15^\circ/s$ | 0 - $70^\circ/s$ |
| Pointing Error | | 0.21° | |
| Angle Feedback | | Step-counting with Hall Sensor referencing | Optical incremental encoder |
| Endstops | | Hall sensors Hard stops | |
| Launch Lock | | Lock of both axes by one Hold Down and Release Mechanism with low shock Separation Nut | No Launch Lock |
| Launch Lock | | | |
| Launch Lock configuration | | Lock of both axes by one Hold Down and Release Mechanism | No Launch Lock |
| Separation Nut | | Low Shock Separation Nut | |
| Separation Nut Activation | | $5A > 50 \text{ ms @ } 1.2 \Omega$ | |
| Operational Life | | | |
| Life Time | | 15 years | |
| Life Time Cycles (incl. margins) | | > 8 mil. cycles | |
| Life Time Angle (incl. Margins) | | > 800 mil. $^\circ$ | |
| Drive chain (Az. & El.) | | | |
| Drive chain configuration | | Stepper motor (redundant coils) with planetary gear and spur gear | |
| Gear ratio | | 40.9 | 17 |
| Full step angle (Az. & El.) | | $< 0.05^\circ$ | $< 0.11^\circ$ |
| Operating Current | | 0.7 A | |
| Peak Current | | 1.0 A | |
| Pow. Holding Torque (Az. & El.) | | 9.7 Nm @ 0.7 A | 4.3 Nm @ 0.7 A |
| Running Torque | | 4.8 Nm @ 0.7 A and max. angular velocity | 3.2 Nm @ 0.7 A and max. angular velocity |
| Nominal Motor voltage | | 25 V | |
| Phase resistance | | $7.5 \Omega \pm 10\%$ | |
| Phase inductance | | $13.0 \text{ mH} \pm 10\%$ | |

***** Note:** Options cannot be combined independently and are subject to individual assessment. Get in touch with us!

| | APM | Options *** |
|--|---|--|
| RF Chain including antenna | | |
| Waveguide | WR-34 | WR-42, WR-112 |
| Frequency | 25.5 – 27 GHz (K Band) | 23 GHz (K Band) 7 GHz to 8.5 GHz (X Band) and other on request |
| VSWR max. | 1.2 | |
| Average power rating | 70 W | |
| Insertion Loss | 0.8 dB 0.7 dB @ ambient temperature | |
| Group delay variation | 0.1 nspp within any 600 MHz bandwidth | |
| Antenna diameter | 0.22 m | |
| Antenna gain | 33 dBi | |
| Mechanical Dimensions & Mass | | |
| Box dimension in stowed position | | |
| Parallel to S/C interface | 320 mm x 375 mm | |
| Height | 340 mm | |
| Mass (excluding margins) | < 15 kg | |
| S/C Interface | 6 through holes for M8 on a circle D180 2 dowel pins D6 on a circle D180 | |
| First mode frequency in stowed position | > 160 Hz | |
| Qualification Temperature Levels | | |
| Ground Handdling / Testing | 22 ± 5 °C | |
| Storage | 20 ± 10 °C | |
| Operational | -50 °C to 85 °C (Antenna -150 °C to 150 °C) | |
| Non-Operational | -50 °C to 90 °C (Antenna -150 °C to 150 °C) | |
| Mechanical Qualification Levels (in and out of plane) | | |
| High level sine vibrations: | | Qualification Levels |
| | 5 – 20 Hz | ± 10 mm |
| | 20 – 100 Hz | 20 g |
| Random vibrations: | 20 – 100 Hz | + 6 dB / oct |
| | 100 – 350 Hz | 0.8 g ² /Hz |
| | 350 – 2,000 Hz | - 6 dB / oct |
| Global | | 21.4 g _{rms} |
| Shock | 100 Hz | 40 g |
| | 800 Hz | 900 g |
| | 1,600 Hz | 1800 g |
| | 10,000 Hz | 1800 g |



Control Electronics (Option)

Mass & Dimensions

| | |
|--------------------------|-----------------|
| Mass (excluding margins) | < 5 kg |
| Dimensions | 300 x 250 x 122 |

Electrical

| | |
|------------------------------|---|
| Power Supply | 28 V unregulated |
| S/C Interface | Power, MIL-STD-1553B for commands, discrete lines |
| APM Interface | Stepper Motors, motors and mechanism temperatures, Hall sensors |
| Max. Motor Current per motor | 1 A |
| Microstepping | Tunable up to 64 |

Qualification Temperature Levels

| | |
|----------------------------|-----------------|
| Ground Handdling / Testing | 22 ± 5 °C |
| Storage | 20 ± 10 °C |
| Operational | -25 °C to 65 °C |
| Non-Operational | -30 °C to 65 °C |

Mechanical Qualification Levels (in and out of plane)

| | | Qualification Levels |
|-----------------------------|---------------------|-------------------------|
| High level sine vibrations: | 5 – 20 Hz | ± 10 mm |
| | 20 – 100 Hz | 20 g |
| Random vibrations: | 20 – 100 Hz | + 3 dB / oct |
| | 100 – 300 Hz | 0.77 g ² /Hz |
| | 300 – 2,000 Hz | - 5 dB / oct |
| Global | 21 g _{rms} | |
| Shock | 100 Hz | 40 g |
| | 800 Hz | 900 g |
| | 1,600 Hz | 1800 g |
| | 10,000 Hz | 1800 g |