

# Custom 2-Axis Gimbal for Remote Sensing Instrument Test and Qualification

Remote sensing is used in aerial or ground-based sensor technologies to monitor, track and analyze objects in a distance. Detection and data collection with remote sensing are essential in satellites, aircrafts, spacecrafts, ships or helicopters, and gathered data and images are applied in various fields such as environment (disaster prevention), education, agriculture and military operations.

A Newport customer, a well-known government funded research institute leading development of electro-optics and remote sensing technologies in Asia, uses a customized 2-axis Azimuth-Elevation gimbal for Proto-Flight Model (PFM) verification and optical quality testing of a telescope. The gimbal system consists of three high precision RTM660BL rotary stages, the center stage providing azimuth motion and the two outer stages providing elevation. It is an ideal platform to test and measure specifications of the electro-optical system in various orientations and to demonstrate the ability to meet all the functional requirements after design, fabrication and assembly.

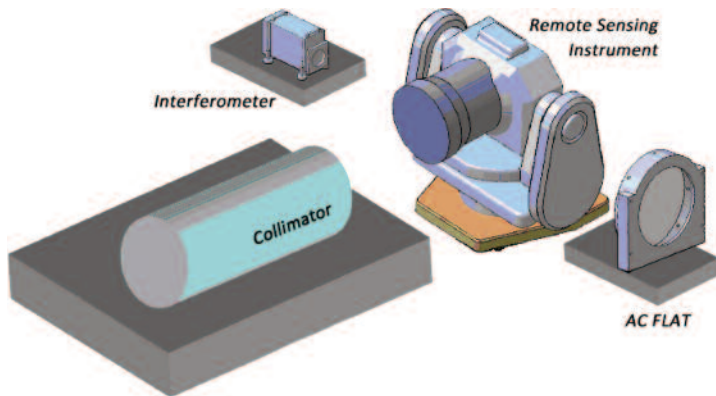


Figure 1: Setup Configuration for Optical Quality Testing with Gimbal

The Device Under Test (DUT) has a dimension of 1500 x 1500 x 1350 mm (width x length x height) and a weight of 160 kg. The accuracy, repeatability and minimum incremental motion requirements are 0.01°, 0.005° and 0.002° respectively, and the needed travel ranges are 340° for both axes. Due to the heavy weight and the large size of payload, design of two axes gimbal requires large diameter, high load rotary stages with high inertia capacity. Customized Newport RTM660BL stages with integrated on-axis RENISHAW encoders meet all the requirements, supporting up to 600 kg load on each axis. The RTM660 series have been widely used to construct the most

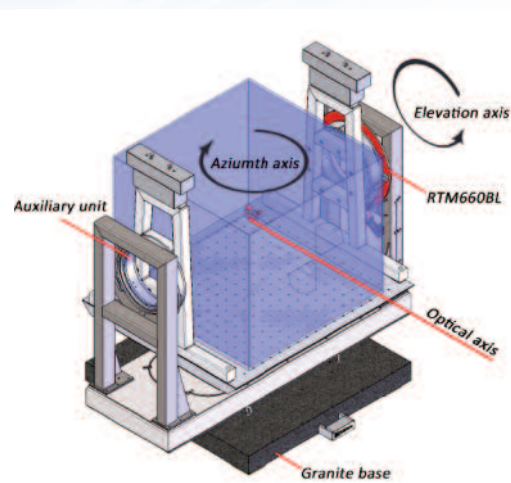


Figure 2: 2-Axis Gimbal Structure with RTM660BL stages

sophisticated goniometric assemblies such as X-Ray diffractometers for synchrotron facilities, and the stage is capable of supporting up to 10 tons of load with a special ball bearing enhancement.

A welded frame with steel counterbalances is mounted on a granite base (2000 x 2000 x 2000 mm), ensuring high surface flatness for a stable operation. (Figure 2) High strength and tight flatness tolerance make the granite structure particularly suitable to large-scale systems with heavy static loads. For the Elevation motion, the RTM660BL is used on each side of the welded frame, and the two rotary stages are electronically synchronized, using a Gantry mode of an XPS controller. The 3rd RTM660BL stage, mounted at the bottom center, provides the Azimuth motion. The two rotation axes are aligned to be orthogonal within 50  $\mu$ rad, minimizing crosstalk errors.

The three XPS-DRV00 pass-through boards are integrated in the XPS controller, driving the RTM660 stages via external amplifiers. The gantry mode of the XPS controller ensures all motions including motor initialization, homing, and emergency stops of two RTM660 stages in the elevation axis are done in a perfect synchronization.

A Newport gimbal system can be customized to meet the various positioning requirements for different types of payloads in a remote sensing application. Figure 4 illustrates another design of Azimuth-Elevation gimbal that is used to test and calibrate an electro-optical payload with integrated remote sensors inside a vacuum chamber.

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## Key Specifications:

Azimuth and Elevation Stages:

Custom RTM660 with brushless motor and on-axis RENISHAW encoder

- Axis Travel Range(s):  $\pm 170^\circ$
- Axis Min Incremental Motion:  $0.002^\circ$
- Encoder Resolution:  $0.0001^\circ$
- Axis Velocity:  $1.6^\circ/s$
- Axis Accuracy:  $0.005^\circ$
- Axis Repeatability:  $\pm 0.001^\circ$
- Axis Centered load capacity: 6000N

Controller: XPS-C4 controller with (3) XPS-DRV00

Maximum centered load for system 2000N



Figure 3: Newport 2-Axis Gimbal for Electro-Optical System Testing

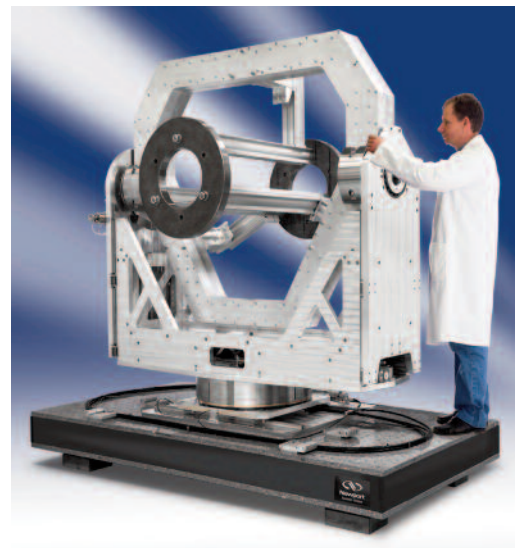


Figure 4: Vacuum Compatible 2-Axis Gimbal Design for Electro-Optical Payload Testing

For questions about Newport motion solutions with gimbal assembly for remote sensing applications, please contact Newport sales and application engineers at [tech@newport.com](mailto:tech@newport.com).



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