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Custom positioning solution for wind speed measurement system

An innovative Wind Resource Measurement System is used to determine optimal sites for offshore and onshore wind farms. A customised positioning solution with ceramic motor technology offers precision and robustness.



ZephIR, a laser anemometer, is an easily transportable ground-based instrument combining three sealed pods for laser optics, data collection/communication electronics and battery power. In simple terms, ZephIR projects a conical infrared beam to illuminate particles in the atmosphere which are detected as backscattered light by an integral receiver. Target particles along the beam produce a Doppler shift allowing the processed information to determine wind speed and direction in five preselected, highly accurate and repeatable distances up to 200 metres above the instrument. Wind speed, direction and wind turbulence information can be stored in flash memory or transferred to clients via mobile phone or satellite.

The technology is proving to offer a significant advantage over traditional wind measurement masts which involve the costly erection of large structures, require lengthy building permission timescales, and also elicit health and safety concerns.

Heason's initial involvement in the project was with QinetiQ, a leading global research and development laboratory that began working on a commercially viable solution for wind measurement back in the early 2000's using its extensive knowledge of Li-DAR (Light Detection and Ranging). The product is now field proven and licensed to Natural Power; a leading renewable energy solutions provider based in Scotland.

The brief was to design and deliver a robust single-axis sub-micron positioning assembly for the high speed focussing of the fibre-optic lens arrangement which in turn determines the application-critical height accuracy. The scope of supply covers a ringtype mechanical assembly with a ceramic servo motor, a linear positioning stage with precision bearings, an optical linear encoder capable sub-micron measuring steps, and fibre-optic lens fixturing. Furthermore servo drive amplifier and motion controller with all interconnecting cable assemblies were supplied to carry power and signals through the three separately sealed GRP pods. The specification calls for high acceleration and high speed to maintain the ZephIR's 20 millisecond measurement window whilst maintaining the positioning resolution requirement at the microns level over a travel range of 15 mm.

As ZephIR can be subjected to hostile environments as extreme as desert summers or arctic winters, and is left unattended in remote areas over several months or even years, all components need to comply with strict performance and reliability specifications. In addition, the instruments' overall battery power consumption of approximately 100W continuous, requires the motor, drive and motion controller's power usage to be minimal.



The HR series ceramic motors from industry leader Nanomotion have a proven record in harsh environments with demanding applications in semiconductor and biomedical, including harsh ultra high vacuum environments. A significant and unique advantage over traditional motor technologies is its ability for inherent braking under zero power conditions. A further advantage and of particular significance for this application is the ceramic motor's absence of servo dither, ensuring high stability for beam focussing. In combination with Nanomotion's AB series dedicated digital drive amplifier which operates from a 12 VDC input, extremely low power consumption is achievable. The reduced amplifier package size is designed for exceptionally compact mounting and its single two-row header connector provides for straightforward installation or field replacement.

To ensure ease of installation in ZephIR's space restricted electronics pod, a compact PC-104 board level motion controller provided the optimal solution. With advanced motion trajectory generation, real-time multi-tasking capability and 48-bit floating point math, the sophisticated motion controller synchronises real-time high level commands from ZephIR's data acquisition software to produce the rapid linear motion profiles and fast settling times required for beam focussing.

The customised design service team continue to work closely with Natural Power engineers to develop and optimise the motion control solution for this interesting and pioneering application. Customised designs for single- and multi-axis positioning systems have been applied to many interesting and challenging applications in aerospace & defence, printing and packaging,

semiconductor and photonics, simulation and robotics.

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