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Gear technology helps measure satellites

The latest gear technology from Harmonic Drive, manufacturer of precision gears and actuators, is helping to power what is believed to be the world's tallest coordinate measuring machine (CMM).

Perhaps most importantly, the Harmonic Drive component sets are helping to improve the accuracy and overall performance of the innovative CMM, designed and manufactured by the ITP Group for the Beijing Space Authority.

The 7.3m high CMM is being used to measure the external dimensions of the latest generation of compact commercial satellites that typically measure around 6m high by 3m square. The size and complexity of the application meant that ITP had to alter the fundamental design of its existing machines, replacing the standard horizontal arm structure with an innovative tapered horizontal arm arrangement that extends from a column, which is constructed from a series of interlocking angled plates.

This unique design gives the machine extra rigidity and enables precise tolerances to be achieved even when at full extension.

Replaces earlier planetary gearboxes

The vertical and horizontal positioning of the measuring probe are controlled via a high precision Harmonic Drive HFUC gear unit. This replaced earlier planetary gearboxes and are based on proven Harmonic Drive gear technology, with each set being constructed from interlocking Circular Spline, Flexspline and Wave Generator mechanisms to offer exceptionally high levels of positional accuracy and repeatability. In addition, the unique

construction of each Harmonic Drive gear unit enables the common problems of backlash to be eliminated, while the HFUC units also feature shortened Flexsplines, to reduce the axial length, and high performance IH tooth profiles, which provide significantly increased torque capacity by comparison with gears incorporating traditional involute gear tooth profiles.

For ITP, the Harmonic Drive component sets are a critical part of the new CMM machine, as Managing Director, **Dick Turpin** explains. “Although the planetary gearboxes that we used previously were fit for purpose we have found that the switch to Harmonic Drive gear technology has made a considerable difference to the performance, reliability and functionality of our latest machines. In the unique, large satellite measuring system, for example, the Harmonic Drive component sets are enabling us both to manufacture an extremely accurate machine, typically to within 0.15mm volumetric, and to ensure that measurements are consistent to within plus or minus 0.6 seconds of arc”.

“Quick and simple”

He continues, “Perhaps as importantly, the units are relatively quick and simple to install, with features such as the high radial load capacity of the output bearing allowing us to mount directly to the pinion; similarly, they are compact and lightweight with a hollow central shaft, so we can minimise the overall dimensions of each CMM machine, which makes construction, shipping and set up even simpler”.

The success of the first ITP CMM machine for the Beijing Space Authority has subsequently led to further orders from the same company, with interest now growing from a number of other organisations in China. As Dick Turpin adds, “The key to our success as a UK manufacturer and exporter is our focus on developing highly specialised machines that offer unrivalled levels of precision and performance; to achieve this we depend on our key suppliers, such as Harmonic Drive, who provide us with the leading edge technology we need for long term export growth.”



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