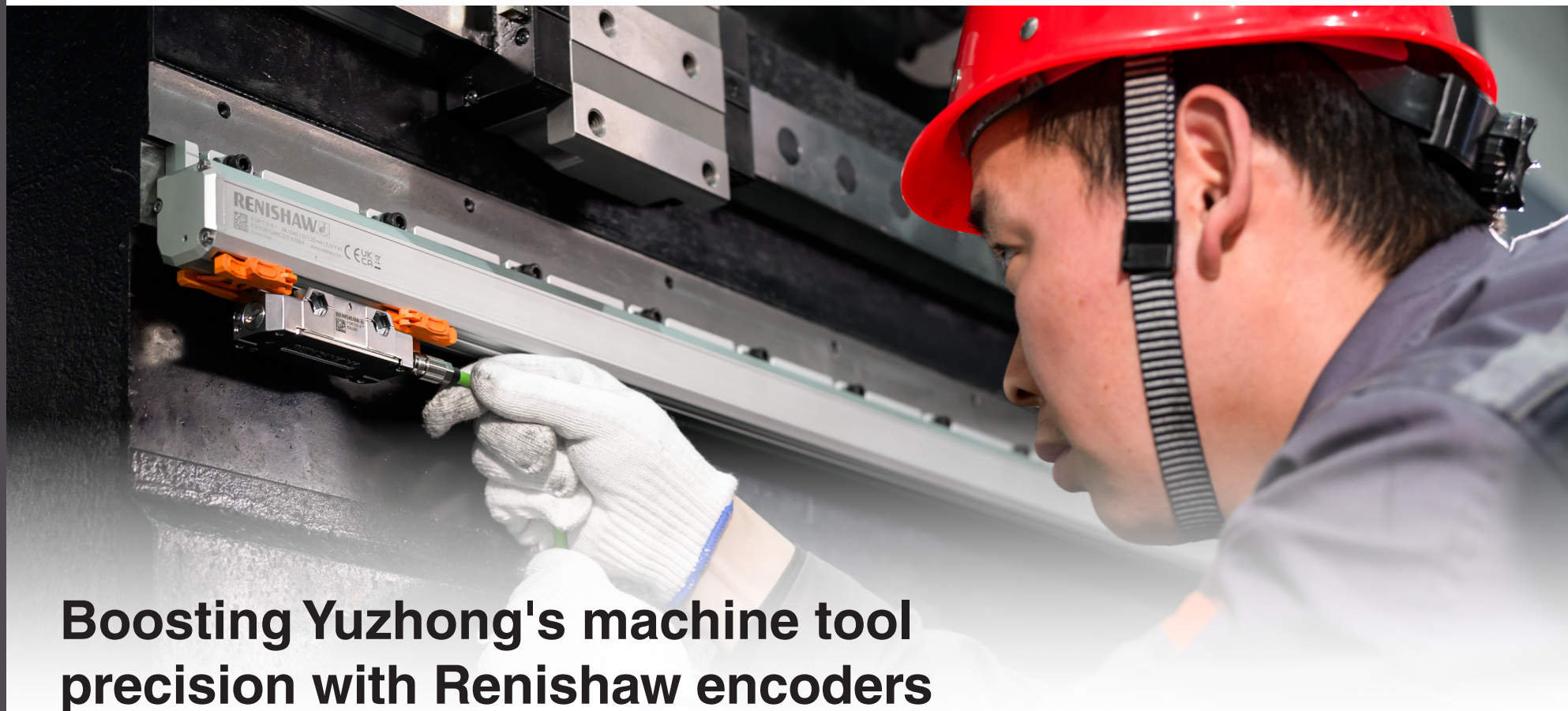




Boosting Yuzhong's machine tool precision with Renishaw encoders



Background:

Nanyang Yuzhong Precision Machinery Co., Ltd. of China designs and manufactures high-performance precision CNC machine tools such as vertical lathes and five-axis mill-turn machines.



Challenge:

To provide reliable machining of precision parts, Yuzhong requires high levels of machine accuracy and stability, whilst also operating in a harsh environment with significant levels of thermal change, contamination and vibration.



Solution:

Renishaw FORTiS™ enclosed linear encoders provide direct position feedback of the machine axes, improving machining accuracy and stability, under even the harshest conditions.



Renishaw's after-sales support is excellent and their feedback very prompt.



Nanyang Yuzhong Precision Machinery Co. (China)



Case study

Nanyang Yuzhong Precision Machinery Co., Ltd. (Yuzhong) in Henan province, China, specialises in the development and production of high-precision CNC machine tools. It focuses on creating innovative solutions to meet the demanding requirements of industries such as aerospace, mould manufacturing, and precision machinery.

Yuzhong uses an extensive range of in-house equipment to produce nearly 1000 machine tools annually. These include vertical lathes, vertical five-axis mill-turn machines and other equipment.

Yuzhong faced several challenges in developing high-precision machine tools, including the need for high-performance motion control technology, temperature drift compensation, vibration resistance, and long-term stability.

One of the primary issues was temperature drift, which can affect the accuracy of the machine. To mitigate this, manufacturers often implement temperature drift compensation techniques, including the use of low expansion encoder scales and active thermal compensation. Additionally, vibration resistance is essential, as excessive vibrations can lead to machining inaccuracies and wear over time.

Long-term stability is another critical factor, as the performance of machine tools must remain consistent over extended periods. This requires the use of high-quality materials and components, as well as regular maintenance and calibration to ensure the machine tools continue to operate at optimal levels.

Addressing these challenges is crucial to ensuring the accuracy and reliability of Yuzhong's CNC machine tools, especially in demanding and complex application environments.

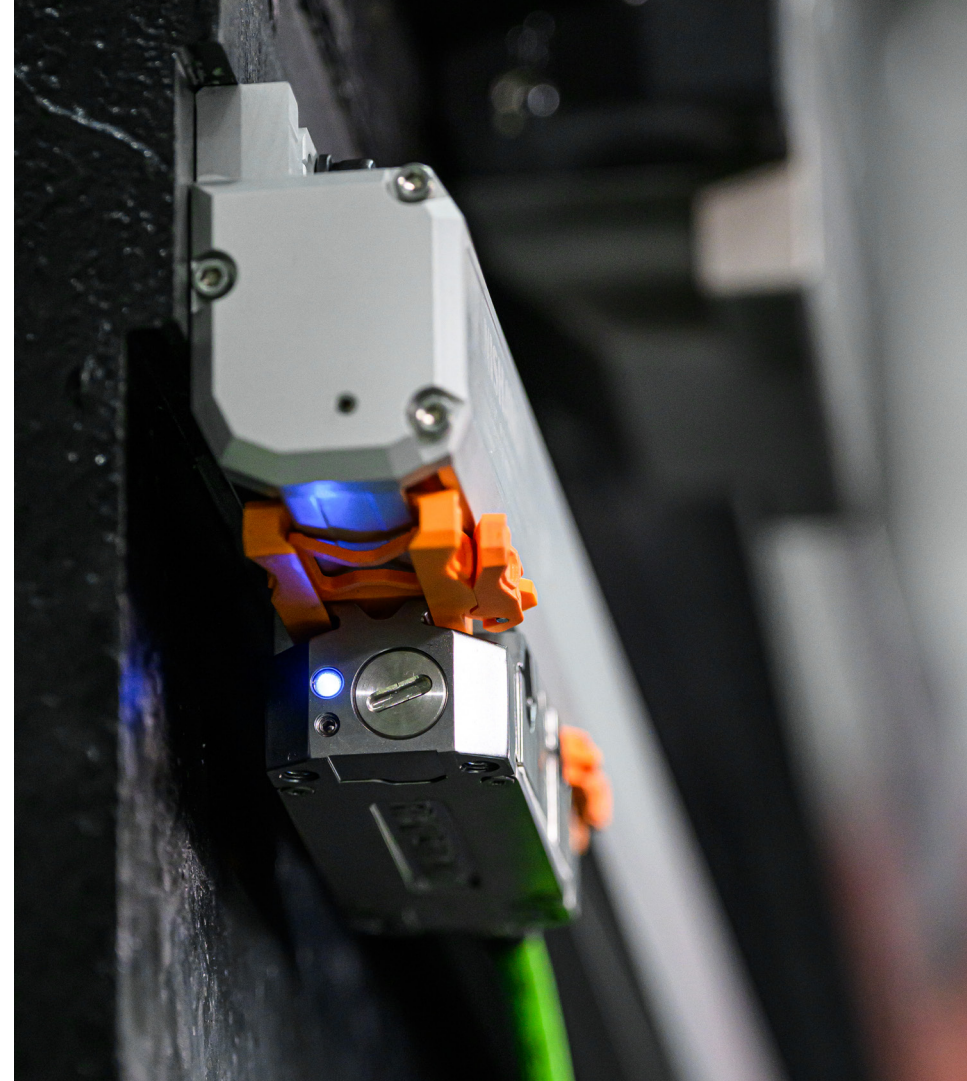


After seven years of research and development, Yuzhong introduced the MT series of high rigidity five-axis mill-turn machines in 2024. The MT1000 features four linear axes which are equipped with Renishaw's FORTiS-S linear enclosed absolute encoders, offering position measurement resolution of 1 nm, and compatibility with both FANUC and SIEMENS controllers. FORTiS enclosed encoders significantly improve the overall measurement repeatability, reliability and stability of the machine.

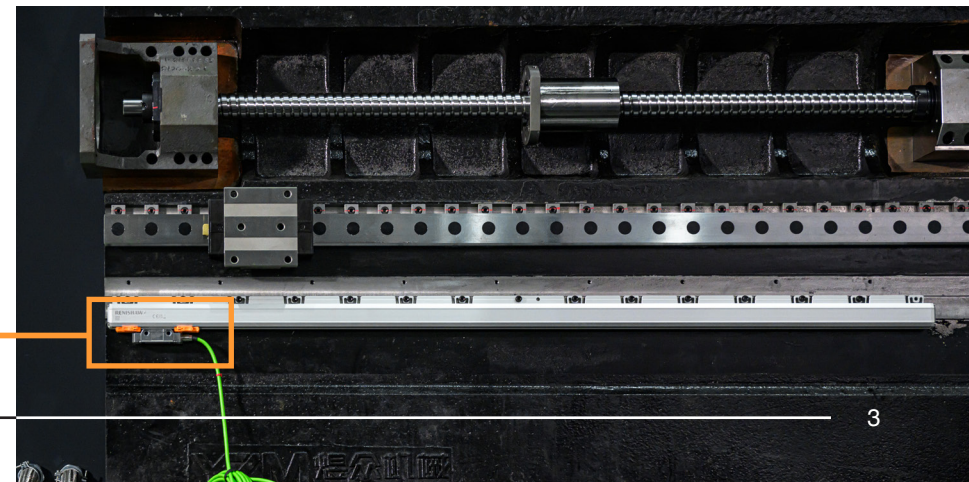
The selected linear encoder scale lengths range from 440 mm to 1,340 mm. Additionally, the MT1000 tool spindle uses a 300 mm diameter Renishaw RESOLUTE™ absolute rotary encoder for position feedback, achieving an indexing accuracy of ± 0.001 degrees.

Renishaw's FORTiS encoder systems are designed for use in harsh environments such as machine tools. They provide high resistance to contamination by fluids and solid debris, thanks to DuraSeal™ lip seals and sealed end caps. These encoders also benefit from the application of tuned mass damping technology, enabling class-leading vibration resistance beyond 30 g and delivering robust measurement performance in harsh conditions. Furthermore, FORTiS encoders feature a robust, non-contact mechanical structure that eliminates internal moving parts, such as bearings or wheeled readhead carriages, improving overall reliability by minimising position errors due to hysteresis and backlash.

The encoder systems offer high-accuracy position measurement with resolutions down to 1 nm and a maximum speed of 4 m/s.



The process of installing FORTiS series encoders is very simple and does not require experienced technicians or specialised equipment.





Mr Geng Xing, Chairman of Yuzhong

The installation of Renishaw's FORTiS encoders was straightforward due to the set-up LEDs on the readhead and meticulously designed accessories — ensuring right-first-time installation in just five to ten minutes per axis. Unlike traditional enclosed encoders, FORTiS encoders do not rely on dial gauges and peripheral diagnostic equipment for installation.

Mr Geng Xing, Chairman of Yuzhong, says: “We really appreciate the design of the FORTiS encoder. It is not just easy to install but also has many unique design features that deeply impressed me. For example, its double lip seal, tuned mass damper technology and non-contact mechanical design. These features not only improve the accuracy and performance of the machine tool, but also extend the equipment’s useful life.”



Yuzhong uses Renishaw's XL-80 laser interferometer to accurately calibrate the motion of each machine tool axis to achieve higher positioning accuracy.



Renishaw's FORTiS encoders have played a crucial role in enhancing the performance of Yuzhong's CNC machine tools. The machining accuracy of the MT1000 improved from $\pm 4 \mu\text{m}$ to within $\pm 2 \mu\text{m}$, as Mr Xing explains:

“Renishaw's after-sales support is excellent and their feedback very prompt. When we first purchased Renishaw encoders, I was very impressed. We had found that our machine tool had a precision of $\pm 4 \mu\text{m}$ without the linear encoder scales. After installing the FORTiS encoder the linear precision improved to within $\pm 2 \mu\text{m}$, which greatly enhanced the machining accuracy and stability of our equipment.”

This improvement enables the MT1000 machine tool to handle complex machining tasks including those required by high-end manufacturing industries.

To optimize the encoder installation process, Yuzhong chose the Advanced Diagnostic Tool, ADTa-100. When connected to a computer running Renishaw's ADT View software, this offers a user-friendly graphical interface of advanced diagnostic information, including key encoder performance parameters such as signal strength along the axis length. A permanent record of installation data can also be saved, providing confidence to both machine tool builders and end users.

The FORTiS encoders' innovative design, ease of installation, and diagnostic capabilities have helped Yuzhong maintain consistent machining quality. This has allowed Yuzhong to position the MT1000 as a reliable solution for applications requiring tight tolerances and superior surface finishes.

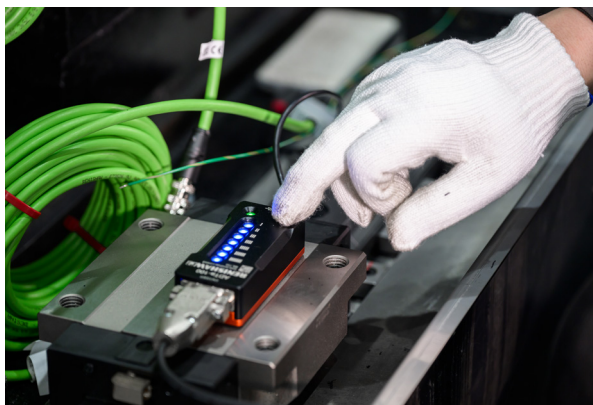
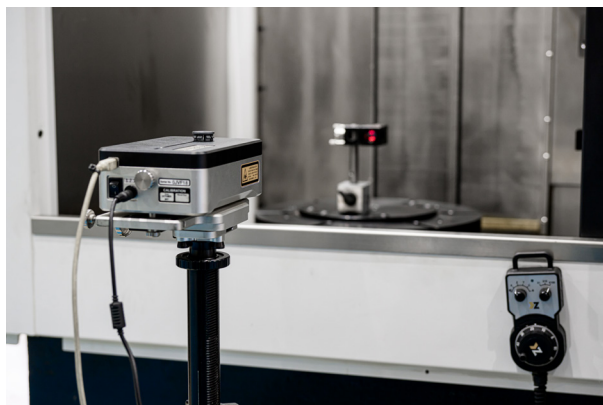




As the trends towards smart manufacturing and Industry 4.0 accelerate, Yuzhong is well-positioned to meet the growing demands of the CNC machine tool market. The integration of Renishaw's FORTiS encoders has not only enhanced the performance of their CNC machine tools, but also provided a reliable and efficient solution that supports the company's commitment to innovation and excellence.

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