

Wind(ings) of change...

Electrifying innovation in motor manufacturing with Mitsubishi Electric's robot solutions

Integrating Mitsubishi Electric's robotic solutions, Horizon Instruments and the Warwick Manufacturing Group (WMG), part of the University of Warwick, have created the first automated solution which combines two key operations in rotor assembly.

This innovative setup for magnetisation and magnet bonding in electric motors includes a compact and flexible setup, which leverages a four-axis SCARA and a six-axis articulated robot arm and offers a wide range of motor sizes and topologies. The unit will play a key role in WMG's Winding Centre of Excellence (WCE), which will be able to offer advanced flexibility, performance, precision and accuracy for the production of next-level motors.

The WMG research institution at the University of Warwick is establishing WCE to help UK manufacturers and supply chain companies deliver the next generation of sustainable electric motors and address electrification needs. The innovative facility received a share of £33m funding from UK Research and Innovation's Driving the Electric Revolution Challenge, whose selected centres have been designed to support the UK in becoming a beacon in power electronics, machines, and drives (PEMD). The WMG Centre High Value Manufacturing Catapult (HVMC) at the University of Warwick also contributed £300,000 in funding.

The centre will be open to external partners and is expected to support a wide range of industry-oriented projects. To succeed, it will feature state-of-the-art winding equipment as well as supporting infrastructures, such as impregnation and machine testing units.

Mark Barnett, Business Development Manager at WMG and Head of Business Development at WCE, adds: "We are building an internationally unique facility that will open its doors in 2023. With its cutting-edge tools and capabilities, it will attract motor manufacturers looking at advancing the development of their solutions for the automotive, aerospace and many other sectors."

Winding innovation onto motor production

One key innovation that the WCE will offer is combined, fully automated magnetisation and magnet bonding within its production line. Typically, in permanent magnet (PM) electric motors, insertion and attachment of non-magnetised magnet blanks within steel laminate rotors are conducted first whilst the magnetisation of these takes place post-assembly. To streamline the process whilst delivering powerful, more reliable motors with less potential for any defects, researchers at WCE wanted to rearrange this process, magnetising first and then placing the components in the rotor.

To create a ground-breaking system that would address this requirement, the research team from WMG contacted Horizon Instruments. The experienced automation system integrator is a member of Mitsubishi Electric's System Integrator Programme (MSIP). In the past, it was selected by research team because of its ability to help in the creation of a traditional bonding and post-assembly magnetisation system. Mark Barnett comments: "Horizon Instruments delivered a high-quality machine that helped our research progress for many years. The company was an obvious choice, as we have enjoyed fruitful collaborations and the specialists know the setup inside and out, so they could offer an upgraded design quickly."

Steve Hilliard, Sales Director at Horizon Instruments, adds: "This is a project like no other and we were delighted to be asked to support with its development. Due to the application requirements and the technical parameters outlined by the WMG, experts from both parties worked together closely to develop the machine."

The best of both worlds

The first aspect to address when designing a suitable solution was offering the level of accuracy and flexibility required by the system. In effect, after being magnetised, magnets tend to be very brittle, making their correct insertion within steel laminate particularly challenging. Therefore, the ideal system should offer extreme position accuracy and repeatability, typically provided by CNC machines. Simultaneously, it was imperative to create a flexible setup that could accommodate multiple motor topologies and sizes, which could only be achieved by using robots.

To overcome this challenge, Horizon Instrument selected two solutions from Mitsubishi Electric. Melanie Bright, Marketing Manager – Strategic Partners at Mitsubishi Electric, explains: "Our four-axis RH-6CH and six-axis RV-2FR robots could meet the requirements, as their repeatability is in the order of ± 0.02 mm, amongst the best in the industry. By using these, the WCE could combine the capabilities of a CNC unit with those of our robots."

The resulting design would see the system use the four-axis robot to collect magnet blanks from a pre-loaded tray and transfer them to a magnetising coil. The six-axis robot, equipped with an adhesive dispensing head mounted on the wrist joint, applies adhesive to the required slots in the rotor. The four-axis robot then collects the magnetised magnets and places them in the prepared slots. Once all the rotor positions are filled with magnets, the machine's doors unlock and the operator can remove the tray and assembled rotor as well as load new components.

Comprehensive product support

After the two robots were specified, Mitsubishi Electric ensured availability and technical support were provided, including for the unit's safety system – the MELSEC-WS Series controller. In this way, the team could streamline the completion of the project. In effect, the machine is now fully operational, ready for the official opening of the WCE in 2023. Steve Hilliard adds: "With a global chip shortage currently on the way, Mitsubishi Electric's support was crucial, and we couldn't be prouder to be member of the Mitsubishi Electric System Integrator Programme."

Mark Barnett comments: "We are extremely happy with the solution and automation components provided and excited to be featuring such an advanced unit in our production line at WCE. It will help us engage with key industry partners and deliver future-oriented solutions based on electrification."

Melanie Bright concludes: "WCE will offer best-in-class winding technologies and it is thrilling to be involved in its creation with our system integration partners, Horizon Instruments. We look forward to visiting the centre when its doors open and supporting the production of new, cutting-edge electric motors."

Image captions

Image 1: This innovative setup for magnetisation and magnet bonding in electric motors includes a compact and flexible setup [Source: Mitsubishi Electric Europe B.V.]

Image 2 + 3: To overcome the challenge of the magnets becoming brittle after being magnetised, Horizon chose two selections from Mitsubishi, their four-axis RH-6CH and six-axis RV-2FR robots [Source: Mitsubishi Electric Europe B.V.]

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Note to Editor: if you would like the text in another language please contact Kiki Anderson at DMA Europa – kiki.anderson@dmaeuropa.com.

About Mitsubishi Electric

With more than 100 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. Mitsubishi Electric enriches society with technology in the spirit of its "Changes for the Better." The company recorded a revenue of 4,476.7 billion yen (U.S.\$ 36.7 billion*) in the fiscal year ended March 31, 2022.

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The role of Industrial Automation – UK Branch is to manage sales, service and support across its network of local branches and distributors throughout the United Kingdom.

**U.S. dollar amounts are translated from yen at the rate of ¥221=U.S.\$1, the approximate rate on the Tokyo Foreign Exchange Market on March 31, 2022.*

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