

Engineering the future of HDD storage

Festo technology enables Lumico, RH Electrical Engineering, and DPB Automation to deliver the world's most advanced HDD automated storage and retrieval system.

A major manufacturer of hard disk drives (HDDs) has achieved 'lights out' operation in its production facility using a unique modular automated storage and retrieval system (ASRS) featuring Festo robotic handling technology. The ASRS was architected and designed by DPB Automation, with the controls and safety solution designed by RH Electrical Engineering, and software developed by Lumico.

Josh Roberts, Head of Applications Engineering at Festo says: "This was a tough project, with many automation challenges. It involved working across international borders, differing time zones, and language barriers — sometimes during the COVID-19 lockdown. Despite all these hurdles, we were able to push the automation envelope and deliver what we believe is the most advanced HDD automated storage and retrieval system in the world."

'Lights out' ambition

The HDD manufacturer produces high-quality solid-state and hard disk drives for personal and enterprise use at its flagship facility in South East Asia. The factory makes around 400 million pieces per year. The production lifecycle of each piece is about 22 days, representing a significant quantity of work-in-progress at any one time. The objective was to reduce human interaction by automating the transfer of product between production cells before packing and shipping.

To improve safety and efficiency, the HDD manufacturer embarked on a three-year roadmap, aiming to create a fully automated 'lights out' factory environment. Automated Storage and Retrieval was central to delivering this vision. Dave Bowyer, head of DPB Automation, says: "Mechanical system development often involves developing an operating principle to go with it. Then follows the necessity for the drives and controls to operate the automation. Festo's portfolio contained virtually everything we needed in this regard. Then, of course, we needed the right software to bring it to life."

This is where Lumico, as the client's incumbent software specialists, came into their own. Steve Kennington, co-founder and director of Lumico, recalls: "Integration with the existing factory automation software was crucial for success because this 'parent' system requests the material in and out of the ASRS. Our existing relationship with the client's engineering teams was a big advantage because the trust was already there."

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Modular design

Delivering a 'lights out' operation for this customer demanded an ASRS with a capacity of 8,500 drives that could achieve rapid cycle times of 3.3–3.6 seconds from 'product in' to 'product out.' These speeds made it impractical to have one monolithic system. Instead, DPB Automation designed a modular system using a four-grid or six-grid configuration to optimise footprint and make use of the vertical space in the factory. There are six systems in all, each running on a cycle time of 19.8 seconds. A further requirement was a buffering capability to accommodate the difference between production rates and process cycle times.

Essentially, the ASRS comprises a large vertical array with a conveyor running through it. Each HDD on the conveyor is bar-coded, and the ASRS automatically identifies and picks product off the conveyor and loads it into the storage slots using pneumatics. Each piece is oriented and tilted to the correct angle, ready for the main handler to come and collect it for storage in the form of a grid. The cant of eight degrees ensures that the drives cannot work their way out of the disk drawers, providing an elegant alternative to using latches and closures on each slot, which would entail actuating each drawer. Gantry robots on the X and Z axes enable parallel operation of the modular units to achieve the desired capacity in the available space.

A further design consideration was that the new ASRS had to be static dissipative to prevent any electrical charge from damaging the HDDs. It therefore uses carbon-loaded plastic for the racking and grounded grid plates.

Automated speed and precision

The system incorporates Festo CMMT-AS multi-protocol servo motor controllers and Festo CMMT-ST multi-protocol 24 V DC servo controllers to achieve the necessary speed and precision when picking and placing the HDDs during storage and retrieval. However, this was no standard Cartesian handling system.

Dave Bowyer explains: "The conventional way to run a Cartesian handling system is to mechanically link the pair of actuators to a single motor so that they work as one. In this instance, it wasn't possible to do that because we couldn't have a mechanical tie across the base of the system. Also, it would have resulted in an extremely large motor that would have created power issues. So, we elected to have independent motors on each Z axis and run them in a master-slave control combination."

In this configuration, the two Festo servo drives in each ASRS module are tied together with a communication link. The controller effectively interacts with one and the second one mimics it. Festo had to modify the software to enable its CMMT controllers to deliver the desired levels of performance.

Operational safety

Safe and efficient operation is an integral part of the final ASRS design. The master-slave configuration has a potentially high cost of failure because the machine would rip itself apart if

the axes got out of phase. To minimise this risk, an ability to cope with a 200mm differential between the Z axes is built into the system. RH Electrical Engineering incorporated a laser beam sensing solution which monitors above and below the end effector for any offsetting and the ASRS will shut down immediately if the axes get out of sync. To avoid any crash risk, the beam detector also checks that no disks are protruding from the storage racks. LED lighting adds a final safety flourish. Running along each horizontal gantry beam, the LEDs give clear visual confirmation of the operational state of each ASRS module in the dark factory. A green light indicates the system is running as intended, blue indicates danger and red indicates a stoppage.

Successful outcome

The new ASRS took just nine months to deliver from a standing start – despite supply chain delays due to the pandemic. Following successful factory integration, the HDD manufacturer has been able to increase and improve manufacturing capacity. The barcoded products also improve traceability, which is crucial to gaining the environmental, sustainability, and quality certifications that are vital to securing future contracts.

Press Images



Lumico 1

Collaborative achievement: the world's most advanced HDD automated storage and retrieval system



Lumico 2

Steve Briney and Steve Kennington, Co-Founders of Lumico, are proud of the way the challenging project came together



Lumico 3

DPB Automation created a unique and extremely effective solution using Festo handling components



Lumico 4

Lumico and RH Electrical Engineering integrated the Festo CMMT servo positioning drives under their IPC control to achieve the necessary speed and precision

Festo GB & IE

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Festo is a leading international supplier of automation technology with a turnover in 2024 of around €3.45 billion. Festo employs over 20,000 people worldwide and is a proven innovator and problem solver in pneumatic and electrical automation, where it is the performance leader. Festo offers around 36,000 pneumatic and electric products in hundreds of thousands of variants for factory and process automation technology, many of which can be tailored to specific customer needs. Sustainability, reducing its CO₂ footprint, digital learning, innovation, performance and speed are the key drivers for the company's future. Festo GB operates as a carbon neutral organisation and uses the PAS 2060 standard externally audited by NQA to validate this claim to customers, employees and other stakeholders.

Festo Industrial Automation's innovative strength is demonstrated through the launch of around 100 new products every year. The company invests over 8.5% of its turnover in R&D, resulting in over 2,600 patents held worldwide. For more information about the company's products and UK / Irish services, please visit: www.festo.com/gb and www.festo.com/ie

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