

Integrated building blocks simplify

By adopting networked control – believed to be a first in the high-end R&D sputtering sector – CEVP estimates it has reduced cabling costs by 50% and system building time by 30% for its new Gamma 1000M advanced sputtering tool

THE THIN FILM ENGINEERING specialist CEVP has shipped its first all-fieldbus-controlled equipment, an advanced sputtering tool destined for MEMS (Micro Electro Mechanical Systems) and GMR (Giant Magneto Resistance) bio-sensor development at the UK's Cavendish Laboratory. The design of the tool – which uses a combination of pneumatic and electrical I/O for control – was greatly simplified by a modular fieldbus automation system from Festo called CPX.

CEVP's Gamma 1000M is optimised for versatility of application. Unlike systems designed for volume semiconductor wafer fabrication, the tool has many advanced features including a much wider temperature and vacuum capability – supporting specialist thin film fabrication processes required for leading-edge R&D. The design of the control software reflects this application potential, and CEVP has many man-years of development invested in the system – which is based on a PLC, but one offering a sophisticated programming language alternative to the conventional ladder logic. This investment, and the fact that changing from a centralised to a distributed control architecture could impact the physical size of the tool, were the key

Jargon busters

MEMS: micro electro mechanical systems. The integration of mechanical components such as sensors and actuators on silicon, using mirco-fabrication techniques.
GMR: giant magneto resistance (or resistive). A thin film technology that exploits the GMR effect to achieve greater changes in resistance.

The modular CPX pneumatic and electrical I/O system from Festo helped CEVP to introduce fieldbus control into high-end sputtering applications. Photo shows the tool's sputtering, cassette change, and cooling chambers

reasons why it's taken CEVP a while to adopt networked control – as the OEM only wanted to make the transition when the right fieldbus I/O solution emerged.

The CPX building block range from Festo provided the answer, as it allows fieldbus nodes with user-defined mixes of pneumatic valve controls and conventional digital/analogue remote I/O to be plugged together, even up to I/O counts of hundreds – a requirement for CEVP. The modules are panel mounting and have a very low profile of just 60mm.

This provided exactly the compactness CEVP needed for its sputtering tools – which are invariably installed in clean rooms where equipment footprint is at a major premium. Despite moving this I/O from the control cabinet into the body of the tool itself, the footprint of the redesigned Gamma 1000M has remained exactly the same.

Choice of protocol completed the selection criteria for CEVP. It chose Profibus-DP from the large range of fieldbuses and protocols supported by the Festo CPX system, as conversations with other system integrators showed this had a reputation for simple software integration, and it also offered



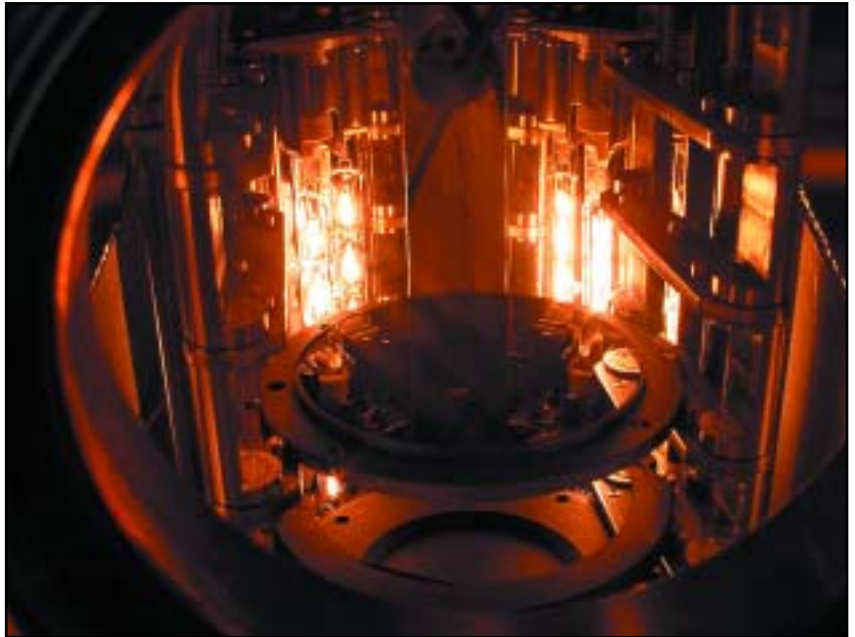
sputtering tool



a good fit for the mix of equipment and instrumentation the OEM integrates.

Festo supplied two main types of automation components for this machine: CPX terminals providing remote electrical and/or pneumatic valve I/O, or both, and a range of pneumatic cylinders and rotary actuators for movement control. Three distributed fieldbus nodes providing around 200 I/O channels in total are used: one has a mix of analogue and digital I/O and sits in the control rack, the other two are mounted directly on the tool and provide a combination of electrical I/O plus I/O for controlling pneumatic valves, and analogue I/O for interfacing sensors. The pneumatics operate a number of movement functions on the system including six rotary actuators that control shutters in front of the magnetron sources, and custom-stroke cylinders that control the processing chamber doors. All the pneumatic components are sealed units that are lubricated for life – optimised for operation in clean environments.

To further simplify purchasing and the equipment building process, Festo is supplying a number of the parts for the redesigned sputtering system as assembled modules – in the same way as it has done for previous CEVP systems – such as cylinders with brackets and sensors attached. These units are assembled at the Festo system building centre in Northampton, and called-off by CEVP using a single part number, for just-in-time delivery as equipment is constructed.



“Redeveloping the control architecture to implement networked I/O had the potential to increase the size of our equipment, and the thought behind the design of this combined pneumatics and electrical I/O system from Festo provided us with a compact answer. It’s helped us to be first to market with networked control in our sector of the sputtering business,” says Ben Jensen, technical director at CEVP. “We build small quantities of extremely complex, high-value equipment, and in addition to high component quality we look for suppliers who can offer us good support. We switched to Festo pneumatics a few years ago because of the technical back-up they could offer, and next-day delivery of components. They’ve never let us down and we’re pleased to continue the relationship with this new equipment model.”

Dave Fraser of Festo adds: “The compact design of the CPX automation building block system proved to be a catalyst for this OEM, helping them to make the switch to fieldbus connectivity with minimal disruption. The hardware costs for this switch to remote I/O work out to within a couple of percent of the previous centralised PLC system – a tiny cost increase that is more than compensated for by savings in wiring and system building labour.”

In addition to equipment building savings, the networked control architecture has given the end users of CEVP’s sputtering tool much greater flexibility. The control cabinet that used to be connected to the tool by a large bundle of cables can now be located wherever there is space in the clean room. Upgrading the tool throughout its lifetime, with new thin-film processing functions, will also now be significantly quicker and lower in cost – as connection into the control system requires just a simple tap onto the network and a software upgrade.

(Above left) The Festo pneumatic rotary actuators that control shutters in front of the magnetron sources.

(Above) Inside the sputtering chamber: exposed magnetrons ‘knock’ atoms off a metal source so that they can be redeposited as a thin film on a wafer

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