

PC Control on a "widget" production line

## Automation equipment from Hayes Control Systems gives beer a better head



Brewing beer has always been a highly skilled craft. But even in this highly traditional sector, modern automation equipment is now used to keep pace with intense market pressure. "Boddingtons", brewed by Whitbread, is one of the best known beers in Britain. A PC-based solution for control of the manufacture of the widgets used was chosen for a new production line designed by ATM Automation. ATM Automation was supported in this project by Hayes Control Systems, Beckhoff's exclusive representatives in Great Britain.

Boddingtons, known as the "cream of Manchester", has been brewed for more than 200 years, and is sold in more than 30 countries around the world, from New Zealand to Hong Kong. The creamy, foaming head is created by a "widget" that springs into action when the can is opened. A widget contains two valves, one valve serves to allow the widget to be charged with nitrogen, and the other is for discharge. The pressure inside a widget that is filled with nitrogen is high. When the can is opened, the gas escapes through a valve no larger than a pin-



prick. This causes the internal pressure to drop, causing an effect similar to that seen in freshly drawn draught beer. The floating widget used in the Boddingtons cans also has a special self-righting mechanism to improve the consistency and appearance of the beer. Widgets were first used in Boddingtons beer cans in 1992.

#### **Software-based controller solution**

Widgets are made by injection moulding, and the entire automated production line was designed and commissioned by ATM Automation. The production line as a whole was installed by Lawson Mardon Packaging, the company that also manufactures the injection moulding machines. The automation equipment, consisting of Beckhoff system components, was supplied by Hayes Control Systems. With the integration of TwinCAT as a control solution, Hayes Control Systems were able to make an offer to ATM Automation that reduced the hardware costs to half of the figure proposed by other manufacturers.

The full production line consists of two pick-and-place units, two loading and unloading units, four welding machines and four test machines. The upper and lower walls of the widget capsules are made separately on two machines. Each of these machines has a double stack tool that can cast 64 parts at a time. Two high-speed robots remove the small capsules from the injection moulding machines, and place them into appropriately prepared pallets on a conveyor belt. The pallets are transported to two loading and unloading units. These insert the workpieces into hotplate welding machines (a total of four), where the upper and low-

er halves of the capsules are welded together. The welded items are then passed to two test stations, where every widget is subjected to extensive functional test. Each widget, for example, is filled with compressed air in order to check it for leakage or any possible loss of pressure. The pressure is monitored throughout the whole of the test process by pressure sensors connected via Beckhoff Bus Terminals. Faulty widgets are ejected into a waste container, and the rest are transported onwards for insertion into cans and filling.

#### **Cost reduction through PC-based control**

Automation of the entire line is controlled by the C6140 Industrial PC, running the TwinCAT software. In essence, TwinCAT is a "soft" PLC system, offering enhanced functionality at reduced costs, compared to conventional PLC and control hardware.

In the ATM installation, 18 nodes of fieldbus I/O are used to control the line, comprising approximately 1200 digital I/O outputs and 128 analog I/O. Lightbus is the chosen fieldbus protocol, with a Lightbus PCI card FC2002 installed in the PC. The program controlling the ATM line is approximately 200 kB in size and scans at 1.3 ms, which is much faster than could be achieved with conventional PLC hardware, that would struggle to scan in 20 ms.

The total automation line comprises two transfer units, two pick-and-place units, four welders and four test machines, with the programming being written to treat each unit as a separate function box, which helped reduce programming time. The TwinCAT software allowed all IEC 61131-3 languages to be used in the pro-



## Hayes Control Systems, Great Britain

Based in Henley-on-Thames, Oxfordshire, Hayes Control Systems is the leading UK expert in the design and supply of complete automation solutions based on open-architecture PC technology. The company is the exclusive UK distributor for Beckhoff. In all of its product areas, Hayes Control Systems champions an open-systems approach which avoids the technical limitations, high costs and restricted availability associated with proprietary equipment.

Technical support and training form an important part of Hayes Control Systems' operations. The company employs a team of qualified and experienced control engineers who work closely with customers at every project stage, ensuring that they select the best possible solutions for their applications, and that they apply the equipment so as to achieve maximum benefit.

Hayes Control Systems was formed in 1994 by the company's present managing director, Stephen Hayes and is now co-owned with finance director Gary Francis. The initial success was achieved through selling and supporting Beckhoff Lightbus products. In 1996, the company's range of operations grew substantially with the introduction of the first Beckhoff soft programmable controller to be offered in the UK market, as well as PCs, panels and bus terminals. At the same time as this revolutionary product was introduced, Hayes Control Systems began to offer a complementary software engineering service.

Since its inception, Hayes Control Systems has expanded consistently, year on year, until it now employs 11 full-time staff, and is achieving an annual turnover growth rate in excess of 50%.

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gramming, enabling the most appropriate language to be used for a particular task. For example, machine sequences are written in Sequential Flow Chart, interlocking is written in Ladder Diagram and maths routines and data handling are written in Structured Text.

### **More than 300,000 widgets in one shift**

The Lightbus fieldbus allows deterministic scanning of the I/O, which is essential to log the pressures in all four test stations, generating 128 analog inputs at 10 ms intervals with critical I/O being scanned by a separate task at 1ms. Positioning was done for the two side entry gantry robots by 2 servo motors with the point to point task within TwinCAT with a 2 ms cycle time. The front end application for the line was written in Delphi and communicates with TwinCAT using an Active X component. This allows the operator to control all aspects of the line from the Control Panel with touchscreen, as well as displaying the pressure profiles of the test units and logging test results to a remote server.

Richard Matthews, Director at ATM is extremely pleased with the performance of the hardware and software provided by Hayes Control Systems, "The Whitbread contract is one of the largest projects we have worked on in terms of value and complexity and Hayes Control Systems has played a large part in this success story.

In addition, this was a project with a stringent deadline and also a sensitive project due to market pressures in the brewing industry. When running at maximum capacity the line handles over 300,000 widgets in each shift. We needed to be

confident that we were supplying our customer with a line that was economic and reliable. The installation of the system at Lawson Mardon has doubled throughput for Whitbread Breweries in the production of the floating widget, ensuring it continues to meet growing sales volumes."

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