

IN TERMS OF INVESTMENT IN ROBOTICS, UK MANUFACTURING INDUSTRY TRAILS BEHIND MUCH OF THE REST OF EUROPE. BUT THE GAP APPEARS TO BE CLOSING AS POTENTIAL USERS COME TO SEE THAT ROBOTS CAN BRING MUCH MORE THAN JUST LABOUR SAVINGS.

According to the International Federation of Robotics, in 2005 Germany was the country with the highest robot density in Europe, with 171 robots for every 10,000 people employed in manufacturing industry. Italy had the second highest robot density (130), followed by Sweden (117), Finland (99), Spain (89) and France (84). The UK came way down the list, with a density of just 44 robots per 10,000 people.

Anecdotal evidence from robotic equipment manufacturers backs up these figures. Graham Hayes, chairman of the Bradman Lake Group, estimates that as a company, Bradman Lake supplied about 40 robot systems last year, but only a tiny proportion of these were into UK manufacturing, with the majority being export sales.

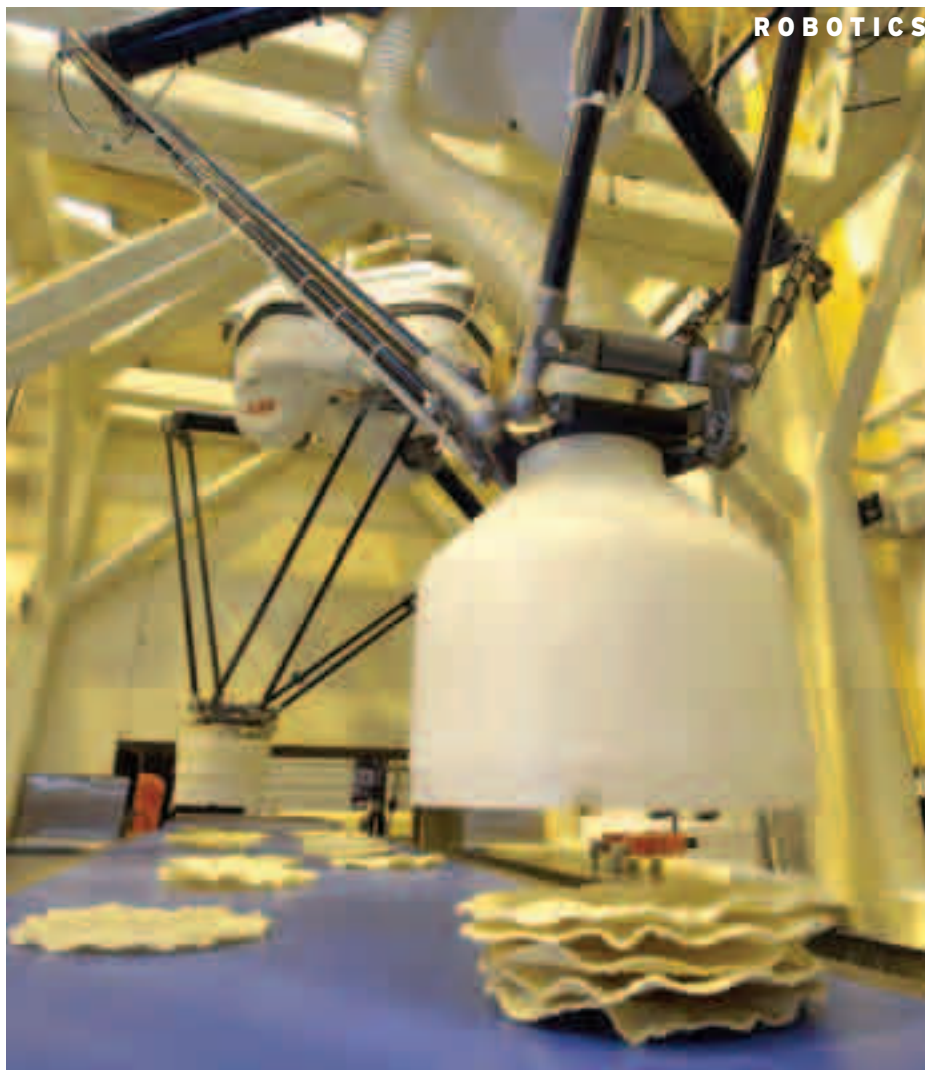
"I don't think the UK is investing enough in robots," he says. "The problem we have in the UK at the moment is that there aren't enough people in places like Grimsby and Humberside who will work in food factories. So the need is there – the problem is getting people to invest in the technology."

So what exactly is stopping UK manufacturers from adopting robotics?

Cost invariably crops up in conversations about the barriers to automation. However, the cost of robots has come down considerably in the last decade – Graham Hayes, for one, estimates that they cost about three or four times less than they did ten years ago.

This should make an investment in robotics much easier to justify, as payback periods can be as short as six or 12 months. However, this message doesn't seem to be getting through to the boardroom, according to Frank-Peter Kirgis, industry segment manager, consumer industries, of ABB's robotics division, with many manufacturers failing to build a convincing case for spending on robotics.

"I see lack of knowledge about how to justify



Handling delicate products: RTS system with ABB Flexpicker robots for loading poppadums

Robotics for packaging More than just labour savings

a robotics project. It's not just to do with reduction of manual labour," he says. "That's a big portion of course, but there are other factors too, such as improved quality control and higher productivity, which are not always taken into account as much as they should in calculations."

A recent installation by RTS Flexible Systems at the Ilchester Cheese Company demonstrates how the justification for robotics can stretch beyond simply reducing manual labour costs.

RTS installed its Pixcell pick-and-place unit on one of the company's cheese portioning lines.

While the primary reason for investing in the unit was to save labour costs on a line manned by two operators, Ilchester Cheese also wanted to reduce costly product giveaway that arises as a result of portioning.

Prior to installing the Pixcell pick-and-place unit, line operators were expected to identify overweight cheese portions. However, as it was difficult to differentiate between the thicknesses of 20g portions at production speeds, oversized portions were slipping through the net.

Now, individual cheese portions are conveyed

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to the picking unit, where a sensor measures the height of each portion.

The information is communicated electronically to the Pixcell controller, which estimates the weight of the portion and combines it with information about the product's position, determined by a vision system. Products within the manufacturer's height and weight parameters are picked and placed into a vac-forming machine, while over and underweight portions are let through the Pixcell unpicked, and collected for recycling. The line operates at speeds up to 150 portions a minute.

Control systems easier to use

Another impediment to robotics which is often quoted is the lack of engineering skills to cover maintenance. In truth, though, the day-to-day maintenance requirements are well within the capacity of an average maintenance engineer with basic on-product training.

Historically, the design and performance of the robots themselves may have proved a limiting factor in some applications. For instance, as Graham Hayes at Bradman Lake puts it: "They were very difficult to control." However, the last few years have seen manufacturers of robotic equipment focusing heavily on making their control systems easier to use. ABB's PickMaster robot packaging software platform, for example, acts as a cell controller for packaging installations with up to eight robots. ABB says the software makes it easier for partners and integrators to incorporate the robot into a system and for users to operate.

With their heritage in the automotive industry, another complaint levelled at earlier generation robots was that they were not really designed with hygiene in mind, limiting their use in the food industry. Today however, robots are becoming more suited to food production environments, with an increasing number of IP67 rated and lighter weight manipulators.

All the machines in Sigpack Systems' range, for example, can be hosed down, and since their joints require no lubrication, the risk of product contamination by grease or oil is eliminated. The grippers which handle the product are also said to be equally easy to clean, either in-situ or after being removed.

Another concern relates to the ability of robots to handle delicate products without damage. Once again, though, recent advances in gripper technology have settled this issue. Indeed, Sigpack has designed a patented vacuum airflow tool specifically for handling fragile



Packing filters: Brita has bought its third Schubert system to pack four different types of filters into cartons

products – even when the products are irregular in shape or size.

RTS Flexible Systems has made great strides in this area too, and has developed a robot that is capable of picking up four cooked poppadums in quick succession and placing them in a vacuum forming machine, at a rate of 100 a minute, with a very low breakage rate.

The system uses a combination of RTS Pixcell vision systems and ABB Flexpicker robots. Key to the installation is the end-effector technology, which enables the poppadums to be handled extremely gently, and the ability of the vision software to determine which poppadums can be picked successfully from the conveyor by instructing the robot to avoid any that are on top of or overlapping one another.

Psychological barriers

It seems then that the real barriers to investing in robotics are psychological rather than physical, in many cases nothing more than fear of the unknown. "People see robots as the stuff of science fiction," says ABB's Frank-Peter Kirgis. "They are hesitant to move over to robotics because they think it's much more complex than it actually is."

It's not all doom and gloom though. The UK might be lagging behind in comparison to the rest of Europe, but the uptake of robots in non-automotive manufacturing sectors is nevertheless increasing slowly.

According to figures from BARA, the British Automation and Robotics Association, 69

robots were installed in the UK pharmaceutical industry in 2005, compared with 45 in 2004 and just 23 in 2003. Growth in the food industry is less dramatic - 2005 saw 51 robots purchased, just one more than in 2004, and seven more than in 2003.

With the use of robots fairly established in end-of-line operations, the most dynamic growth is in applications further upstream, for loading product into primary packaging or linking equipment such as flow-wrappers and cartoners.

"Usually these processes are the most complex to automate, therefore they are the last ones to be automated due to feasibility and profitability," says Sigpack's Roland Czuday. "However, with the promise of labour savings, gentler handling and increased hygiene levels, the motivation for automating these now manually performed processes is really growing."

Schubert reports that it is increasingly being asked to integrate its packaging systems with other in-line equipment such as flow-wrappers, thermoforming machines and bag makers. In fact, the company has just developed a system that takes primary bags from vertical form-fill-seal machines and loads them into the flow-wrapper to create multipacks.

Third system bought

Meanwhile Brita, a provider of portable household filtration, has just bought its third Schubert system to pack four different types of filters into cartons at its factory in Bicester. The TLN-F44 machine incorporates five two-axis robots and

three transfer stations for processing box blanks, pack inserts and lid blanks.

The system erects and glues boxes from flat blanks before transporting them by vacuum slide to the packing station. Once the packs are filled, they are sealed with a lid.

The confectionery industry has a long tradition of automating the carton and tray loading process. Now there are signs that other areas of the food industry that have historically resisted robotics are cottoning on to the benefits of automated product handling.

RTS says it is seeing 'green shoots of interest' from a much wider range of product processing areas. Solutions it has developed recently range from packing individual pancakes into six-packs before flow-wrapping, to packing raw vegetables into acetate trays and mixing and matching dessert pots in mixed flavour trays.

Robotics in the meat industry

One industry where the use of robotics is definitely on the up in the UK is the meat industry. Historically, meat manufacturers and packers shied away from robotics, choosing instead to rely on inexpensive labour. However, increasing difficulties with finding and retaining staff to perform unpleasant tasks, combined with developments in robotic and vision technology, are building a strong case for robotics, and automated handling of raw meats is now a reality.

For example, in one Bradman Lake installation, frozen burgers of different sizes and thicknesses coming off the production line in varied row presentations are being packed into flow-wraps at speeds of up to 400 packs a minute. Robotic stackers/loaders, purpose designed by Bradman Lake, hold the key to this performance.

Bradman Lake has also enjoyed success in Germany with a robotic top load packaging system for frozen fish – an application that few robotic solution providers will tackle.

Royal Greenland processes fish fillets, portions and fish cakes coated with breadcrumbs, flour and batter, as well as bagged seafood products. Bradman Lake installed two packing lines, each comprising six pick-and-place robots, a product locating vision system, a triple head carton erector, a high speed carton closer and a wraparound case packer, to pack products into retail cartons and bulk catering packs.

The two lines are packing in excess of 100 products in varying formats into cartons and cases ranging in size from 106 x 100 x 40mm to 495 x 140 x 190mm.



Frozen fish: Bradman Lake cartoning system installed at Royal Greenland

Indeed, with few new robot purchases being signed-off in the UK, some of the more interesting success stories are playing out elsewhere in Europe.

For example, Loesch Verpackungstechnik has just installed a robotic pick and place system for inserting four different types of chocolate pralines into plastic trays, which vary in size from 83 x 83mm to 315 x 223mm.

Inspected for defects

Chocolates are transported to two robot stations via four transport conveyors, and are inspected for defects as well as position by camera en route, with imperfect product being ejected from the line. At the robot station, chocolates are picked from the conveyor by an ABB FlexPicker robot and inserted into trays at speeds up to 60 trays a minute. Some of the chocolates are in branded wrappers – so the robots align these chocolates before they are placed, ensuring the on-pack text all faces the same way.

Further afield in Hamilton, Ontario, Voortman Cookies is using a robotic packing line from Bosch Sigpack Systems to pack more than 80,000 cookies and wafers into trays and flow-wraps every hour.

Fourteen Delta robots use vacuum cups to

pick up individual cookies from the conveyor belt and transfer them into plastic trays supplied by a tray denester, packing them either upright or on edge. Each robot incorporates a vision system that is programmed to pick up product only of a specific size - all other cookies are ignored and continue down the conveyor to a reject bin. Once the trays have been filled they are transferred to a Bosch Sigpack Systems HBW flow-wrapper, and wrapped at speeds of about 120 trays a minute.

Potential for growth

While the use of robots in case packing and palletising operations is well established, there is still plenty of potential for equipment suppliers to grow their installed customer bases.

Yogurt producer Rachel's Organic Dairy in Wales recently decided to switch from manual case packing to an automated solution, following a period of rapid expansion.

"We were expanding rapidly and could see our labour costs spiralling," says Tim Pink, projects and compliance manager at Rachel's Organic. "There is almost no unemployment in Aberystwyth where we are based. As a result, labour costs are high and there just aren't enough manual operatives available at reasonable notice."

An SR-1054 Scara Toshiba Machine robot was provided by TM Robotics (Europe) and was integrated as part of a wider project by Soco System UK.

Rather than specifying a flow line system, Soco recommended a separate case erector and robot, to keep costs down.

The robot's pick-up head is designed to pick up six cardboard sleeves, each containing six pots, and separate them into two sets of three. The Scara then places the sets, two at a time, into outer cases, which are pre-formed and supplied to the robotic pack point on demand.

Fosroc UK and Ireland, a supplier of specialist chemicals, has reported significant increases in output following the purchase of an Okura A1600 palletising robot from Webster Griffin.

Since installing the robot, which is being used to transfer bulk bags of powder from a conveyor onto pallets, Fosroc says the production rate has increased to over 50 pallets per shift and the three shift rota has been reduced to a two shift operation.

All pallet types and bag designs are set up using a self-teach system, whereby palletising patterns are selected and downloaded to the robot directly from a laptop, with no need to

teach the robot every palletising programme.

Planet Flowline, via its agreement with Italian palletising specialist Zecchetti, has carried out a number of robotic installations in the UK, the latest being a second line at Amcor's PET bottle manufacturing factory at Gresford in Wrexham.

The system, which incorporates a Kawasaki robot, automatically collates unstable empty PET bottles coming from the blow moulder and picks and places them two rows at a time on the pallet, where they are stabilised. The robot also automatically picks and places the tier sheets and top frames and the conveyor automatically feeds empty pallets into the system.

Planet Flowline says it is currently working on more sophisticated palletiser designs where the robot handles the empty pallet, tier sheet, containers and top frames, making the overall cost more justifiable and reducing the footprint.

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For full details of all PPMA members able to supply robots for packaging, consult the PPMA machinery finder service, tel: 020 8773 8111, or visit www.ppma.co.uk

SEWTEC AUTOMATION

UB opts for robotics on Mini Jaffa Cakes line

United Biscuits' McVitie's factory in Manchester has installed a new robot from Sewtec Automation to load outer cases with Mini Jaffa Cakes 'pods', at the rate of six per cycle. The pods themselves are distinctive six compartment, lidded thermoformed trays, which are folded to give the three-on-three pod style.

The robot is the final element of an extensive upgrade by UB on the Mini Jaffa Cakes line, a large part of which was carried out by Sewtec. This includes two McVitie's Jaffa Cakes pod folding units and a two-to-one converger/conveyor system. This transfers the pods from the pod folder units, through a pod sleever, and into the case loading robot cell.

Previously, two methods were used for packing the outer cases. Standard cases were packed using a side-load machine, while the smaller cash and carry cases were loaded by hand.

UB's project implementation manager at Manchester, Steve Ash, decided to rationalise case packing by making the footprint of all cases identical, while varying the number of layers within the case. So the new Sewtec robot loads the pods into the cases in two, three or four layers of six to give 12, 18 or 24 pods per case, as required.

The robot is a Sewtec model 100/20 two-axis, servo motion, pick-and-place design, incorporating a bank of six vacuum heads with two cups per head. The system is controlled using an Allen Bradley ControLogix PLC-based system, installed and configured by Sewtec and incorporating an Allen-Bradley HMI.

United Biscuits expect payback on the cell within 1.2 years, says Sewtec.

Pods enter the robot cell on a Sewtec slat band in-feed conveyor, which are then cross pushed in pairs onto a collating table to give the final layer collation of six pods after three cross pushes. Another Sewtec slat band conveyor queues pre-erected packing cases and cross pushes the first in line onto a flighted indexed conveyor. The cases are then indexed into a position within the cell where the collated pod of six is picked and placed into the case. Cycle time per layer is 4 secs.

Once filled, the cases are transferred to inde-



Upgraded line: Sewtec case-packing system at United Biscuits, Manchester

pendent case taping machines and despatched.

According to Steve Ash, the upgraded production line – allied to improvements in the production process – have raised throughput from 100 to 110 deposits a minute and reduced waste by 20 per cent as well as providing significant labour savings.

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ELAU

Case-packer controls cater for extra robots

A robotic case-packing line equipped with an open architecture control system that provides a simple future upgrade path by allowing up to four extra robot cells to be simply added, on a plug-and-play basis, was introduced at Pack Expo in Chicago last October by American manufacturer Fallas Automation.

The new R700 Adabot, a compact machine with a footprint of 1500 x 1500mm, uses a PacDrive automation controller from Elau that provides processing speed ten times faster than a PLC, contributing to the machine's speed as well as its flexibility.

The PacDrive controller's 1 millisecond response has increased speed over PLC-based controls which, Elau points out, offer response times limited to 10 milliseconds by their processor architecture. The robot's carbon fibre arm also reduces mass while increasing stiffness.

Layer patterns inside the case are selected



Case-packing flexibility: Fallas robot with Elau controls can load a variety of layer patterns

via a simple recipe change at the control panel including U patterns which, says Elau could not be produced by conventional machines.

The U pattern places two bags next to each other, then rotates the next bag at their feet to perform the U. Then the pattern is reversed in a 'chimney stack' arrangement.

According to Elau the modular nature of its robotic software library allows Fallas Automation to change robot arm dimensions readily, move profiles, belt height and picking distances – all without additional programming.

This is because the robotics library of the PacDrive system features a transformation module for each of the various robot kinematics such as articulated, gantry, Delta, Scara, or portal varieties, converting the co-ordinates of the robot's Cartesian space into positions for each axis of motion in real time. Several robots can be addressed simultaneously by a single controller.

The robot's trajectories are preset using special motion commands in Cartesian space, which is said to reduce significantly the effort of creating procedural profiles for different products or formats.

An intelligent acceleration monitor is integrated in the control system and directly monitors the acceleration at the TCP (Tool Centre Point) or the centrifugal force on the product in the robot gripper. Direction and magnitude are also monitored.

The controller automatically calculates the maximum speed possible and reduces the path speed in such a way that a preset TCP acceleration is not exceeded. This calculation ensures that the product gripper, which has a limited holding force, does not drop the product.

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CAVANNA

Crumpets placed base to base for flow-wrapping

A two head pick-and-place robot that collates crumpets in stacks with every second tier inverted – to allow them to be packed base-to-base – has been built for a UK bakery group by Italian manufacturer Cavanna.

The robot forms part of a complete Cavanna modified atmosphere packing line, including a flow-wrapper, supplied through UK representative Quest Equipment. Formats handled by the line are two and three stacks of three and two stacks of four.

Crumpets arrive on the cooling band in rows of ten to be picked on each cycle of the G35 robot. Those rows to be handled top up are placed directly on a deadplate by the first head while those rows to be inverted are picked by a second head. This rotates 180deg and delivers the crumpets face down to the grippers of the first head, which then stacks them over the first tier.

Stacks of crumpets are then transferred at 90deg by an overhead paddle system and placed on one side of a U-board, which is then folded over twice before the product is carried into the flow-wrapper, a Cavanna Zero 5 machine with box motion sealing jaws.

The system is able to handle 20 rows of 10 crumpets a minute.

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Stacking the upright tier: The row of crumpets are lifted face up from the cooling band to the deadplate



Stacking the inverted tier: The row is lifted, turned over, and then picked again for transfer face down



CHRONOS RICHARDSON

Compact automatic palletiser for bags

Chronos Richardson has recently added a compact palletiser to its Chrono-Pal range of automatic palletisers.

The PL 900C palletiser features automatic bag gripping to ensure bags are precisely positioned on the pallet every time. For applications requiring optimum stability, the bags can be positioned with overlapping edges.

Speeds up to 2400 bags an hour are possible, and the machine can palletise all common types of open-mouth bags (sewn or heat sealed), as well as paper, plastic or woven polypropylene and valve bags.

The palletising format can be adjusted to suit different site requirements. An in-built programmer allows 14 different patterns to be selected, forming layers of up to ten bags and

stacks of up to 12 layers high on one pallet.

Modular construction means the palletiser can be supplied in four different layout configurations. Additional options like sliding tables for layer forming and lateral pressing, automatic cover sheet placers for protecting palletised bags and bag flatteners for even product distribution are also available.

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CAMA3

Loading cartons with thermoformed trays

Italian manufacturer Cama has developed a monobloc unit for loading thermoformed trays into three-flap cartons. It says flexibility and a small footprint are the main selling points of the new 'form, fill, close' unit.

Three-flap boxes are erected and glued via an integral forming machine. Trays are then top

ROBOTICS

loaded into the boxes at speeds up to 160 a minute and the boxes are closed.

Cama says the use of a two-axis robot has enabled a considerable footprint reduction, as well as a simpler product in-feed and handling system.

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HERBERT INDUSTRIAL

Case packer promises flexibility on food

Herbert Industrial says its latest Matrix 80i pick and place cell is designed for food industry case packing operations where system flexibility is a key criteria.

The system incorporates a Fanuc M6i robot, which is capable of picking and placing up to 80 packs per minute.

Variable position marshalling and low friction conveyors enable the cell to be programmed to collate different sized packs prior to picking by the robot. Zoned picking hands use vacuum cups, enabling partial drops, which, when combined with Fanuc's rotational axes, are said to create particularly flexible pick-and-place operations.



Designed for food applications: The Matrix 80i pick-and-place case-packing cell from Herbert Industrial

The cell can be controlled via Herbert's Gemini Lightning weigh labeller or, for standalone systems, through the robot's interface.

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GRUNWALD UK

Crate loading system for loaves and rolls

EMB Technik has developed a robotic solution for placing loaves and bagged bread rolls in crates, which is now available in Britain through Grunwald UK.

Product is transported to the robot station via a single conveyor and placed in the crates using a sorting system based on a selected loading pattern. The robot will not only place the bags in the crates but will also stack the crates on dollies and close the clasp if required.

Picking and placing bread is a delicate operation, as bread is often topped with seeds and the like, which can be damaged, points out Grunwald UK, and the softness of the product means it is easily deformed if handled carelessly. EMB has overcome this issue, says the company, with flexible suction cups which pick and place the bread in a controlled manner.

EBM can also integrate bread scanners and cameras into the process to carry out quality control checks.

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