Not so much detection, more a Sense of inspection

SPECIALIST SENSORS NOW AVAILABLE ARE MORE A MEANS OF INSPECTION THAN JUST DETECTION DEVICES, WRITES SIMON MARSDEN. CHECKING SHAPE IS JUST ONE FUNCTION.

Modern production techniques require individual manufacturing lines that are capable of running a multitude of different products with varying dimensions and tolerances, across a broad range of packaging types. Also, there is an increasing use of sub-contractors by brand owners – especially for packing and filling.

At the same time, demand for fast market response and the trend for global multi-site production means there is an increased need to be flexible. However, standards and uniformity have to be maintained regardless of different environments if quality is to be consistant.

As a result, there is now much greater emphasis on product inspection, often leading to 100 per cent checking.

Sensor manufacturers have kept pace, developing equipment to provide this level of inspection which, coupled with statistical production data, will also alert maintenance departments of pending machine and process problems.

Some of the most common techniques used in sensing are: mechanical, photoelectric, inductive, capacitive and ultrasonic.

Each has its limitations. For instance, mechanical limit switches rely on product-to-switch contact which could cause product damage, while the moving mechanisms offer limited response and are therefore not suited to high speed operations.

However, photoelectric cells are well suited to high speed, non-contact applications. They operate by monitoring the light returning from the transmitter and give a signal when the beam is interfered with. However, speeds, distances, ambient conditions and physical properties of the object being detected – size, colour, texture and so forth – must be taken into account to ensure success.

In general, most conventional sensors are limited in their scope. They can be used to indicate a position has been reached, detect the presence or orientation of an object or count products on a production line.

Developments taking place at this level are aimed at ease of use and installation and include common sensor families and mounting arrangements, multi-voltage supply and output types switchable between PNP and NPN, and quick electrical connection using screw-in sensor leads.

Push-to-teach is a major step forward, since it allows the sensor to be set up using a single push-button or via an external input, such as the line control system when setting up for a new batch.

Inspect don't detect

The new breed of specialist sensors now available provides much more than simple detection. They can be used more as an inspection tool to measure dimensions, grade objects according to some predefined tolerance, check colours and confirm correct assembly of each product.

With this in mind, quality checking can be increased to weed out faulty products before they reach critical stages in production or the supply chain. Additionally, sensors that generate analogue output values have a secondary benefit: by monitoring these output values over time, judgements can be made on the condition of the process or production line equipment.

Typical inspection point: *An application for Omron's F10 pattern matching sensor*

Armed with this information, operators can adjust machine parameters to ensure tolerances are maintained while, in other circumstances, maintenance staff could be warned of the need to carry out urgent repairs to prevent failure.

Industry has always recognised the benefits of this level of inspection, but justifying the additional costs, complexities and support this involves has not always been possible in the past. One particular example was expensive vision inspection systems.

Unfortunately, in many instances where inspection systems have been justified and retrofitted to production lines, they have tended to be concentrated towards the end of the line. Faulty items are returned to the line to be reworked, but only after they have taken up expensive production resources.

Logically it is better to invest in detecting and rejecting potential problems as early as possible, hence the importance of analysing critical points in the production process to ensure suitable inspection points are installed on the line.

Inspecting each new working stage or process, be it during filling, capping, labelling or later on during the wrapping and case-packing stage can only lead to increased productivity. It will highlight problem areas and ensure that quality is maintained along the line by rejecting defects early.

Cost obviously plays a part and the return on investment will vary in each application, although modern sensors offer increasing levels of inspection at lower cost. For as little as a few hundred pounds it is now possible to install a vision system to carry out a number of production based inspection checks, including many which in the past required human intervention

to confirm quality. This has the added benefit of avoiding human error as a result of tedium and poor concentration.

Vision systems

For several years now, sensors have been available that are ideally suited to production line inspection applications in which conventional sensors are unable to detect any subtle changes over time. Typical systems consist of one or more cameras, an amplifier/processor and lighting, although a number of sensor manufacturers have options that combine some or all of these into a single unit.

Many machine designers and end users are, however, reluctant to employ vision systems, believing them to be hard to use, bulky and expensive. Certainly, this may have been the case several years ago when only complex and expensive PC based vision systems were available. However, in many packaging applications this level of sophistication is not required.

The latest vision sensors have been designed to overcome these early objections. Not only are they easier to set up and use – through menu driven configuration and programming as well as memory for product parameters that can be automatically recalled at a later date – but include cameras with built in lighting that are as small as 70mm square. Added to this, prices for basic systems can start from as little as a few hundred pounds.

Among the various types of vision sensors, pattern matching units are the most basic form. Here they detect the grey scale pattern of the object and compare it with a pre-stored pattern image held in memory and output a relevant result. This method can confirm presence and indicate whether the position, alignment, conformity and quality are correct.

More complex vision sensors use pixel counting for greater inspection accuracy. Combined with additional intelligence and processing this extends their capabilities into more advanced inspection applications that were once only achieved with expensive PC based systems.

For example, this sensing method could be used to recognise and inspect a number of different objects as they pass randomly down a conveyor. Based on which object it is and its orientation, a number of discrete inspections are carried out. Another example might include finding and recognising the positions of various objects: these X-Y co-ordinates are then acted on by a motion control system.

Vision systems with these capabilities tend to start just under £1000 and go up to several thousand pounds depending on the model, camera and type of lighting required. Additionally, most vision systems have various options such as built in I/O to allow the unit to work completely independently or serial communications to integrate with other control systems. Applications are numerous but could include the following:

Print mark sensing: *Example of printed mark sensing used in registration applications*

- Optical Character Verification and Optical Character Recognition for identifying and confirming print such as dates or serial numbers on labels – even though characters could be distorted or degraded.
- Checking pack damage or that the pack is correctly sealed.
- Establishing correct positioning of labels in absolute and relative terms: for instance that multiple labels on a product are all within a given tolerance of each other.
- Orientation: confirming that product is correctly positioned in its packaging or that the logo and text are correctly sited.
- Grading products, such as by colour, size or shape.
- 2D matrix code and linear bar code identification.
- Accurately identify components or sub-assemblies to ensure completeness.
- Inspect a wide variety of visual features, for example that the neck of a plastic bottle is the correct diameter with no deformation that would prevent the cap sealing it.

High speed packaging

With the increasing use of servo control systems on high-speed packaging machines operating at reduced cycle times, some form of registration is required to synchronise and maintain velocities, accelerations and the distances travelled by the machines' axes. Here the emphasis is on fast sensor response times, the capability of operating across a broad range of variables, be it speeds, product characteristics, colours and textures or sensing distances.

Take, for example, the case of wrapping machines or form-fill-seal machines. Here, sensors are used to detect pre-printed marks on the web or film. It is crucial that sensor signals are accurately and repeatably sent to the motion control system to ensure that the product and its packaging are brought together in correct alignment.

There are, of course, numerous further examples of applications for sensing systems

- Clear object detection such as plastic bottles present particular problems, however, detection is possible using special sensors that may include a reflector mounted behind the object being detected.
- Grading and sorting products according to their shade and colour is possible. By transmitting a red, green and blue light source on to the object and comparing the reflected light to previously stored reference tri-stimulus values, an output is made if it is within the set tolerance. Options exist to store a number of selectable colour tolerances.
- Accurate thickness of film, paper, corrugated board and fine metal sheets can be established using ultrasonic sensing.
- There are also sensors designed specifically for conveyor use. These fit between the conveyor rollers and can be tuned to sense across the width of the conveyor and ignore foreground and background interference.
- Accurate dimension checking can be carried out using laser sensors: tolerances down to several microns can be checked.
- Luminescence pigments not visible to the naked eye can be incorporated in an item and then picked up using a sensor with an ultra-violet light source.
- Contrast scanners using a variety of colour light sources, combined with high frequency switching, are ideal for printed mark detection. They are less susceptible to problems associated with different surface materials and finishes, for example whether it is paper, plastic or metal, or the surface is coarse or smooth.
- Laser and ultrasonic sensing is ideal for accurate detection over large distances. For instance, laser sensors are used in automated warehousing where vehicles need accurate positioning over long aisles.

*For full details of all PPMA Members able to supply sensing equipment enter **402** on the reader service card in this issue, or visit the PPMA web site: www.ppma.co.uk*

SELO-BOLLANS

Bottom-reel flow-wrapper has vacuum belt infeed

A bottom reel flow-wrapper, in which the film unwinds onto the infeed and bed of the machine to carry soft, loose or sticky products through the form-fill-seal process without a tray or backing card, has been introduced by Selo-Bollans, UK agent for the Japanese manufacturer Omori.

The Omori S5600A-BX-DF machine operates at speeds up to 60 packs a minute and features an infeed some 2.5 metres long, equipped with vacuum belts at the bottom and sides for easier feeding.

Omori's PerfecTension film unwind system compensates for decreasing roll diameter, maintaining constant film tension to prevent wander. An added advantage of this system, points out Selo-Bollans, is that the time left before a reel change is required can be seen at a glance.

Handling sticky products: *Omori bottom-reel machine from Selo-Bollans*

The machine operates with a maximum film width of 450mm and will accept products up to 200mm wide and 60mm high. Minimum cut-off is 110mm.

Optional equipment includes a gusseting device, oxygen absorber feeder and equipment for both MAP and easy open or reclosable tamper evident features.

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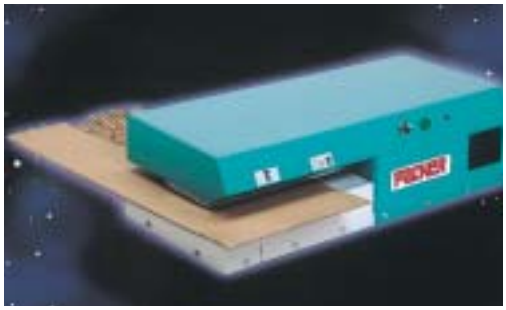
PACKAGING AIDS

Benchtop unit turns waste corrugated into void fill

A benchtop model has been added to the Packer Systems range of waste converters used to turn corrugated and cardboard up to 10mm thick into cushioning material and void fill.

Aimed at low to medium volume users and at companies where usage is unpredictable or seasonal, the machine comes in two models.



Re-using corrugated: *Packer machine makes cushioning*

The first makes cushion wrap for protecting bottles or porcelain, interleaving ceramics and delicate goods or where a strong protective sheet is desirable. The second produces cushion filler, a compressed material for packing products from glass to machine parts and general void fill use.

More information - enter 102

KHS KISTERS

Carry handle applicator can run at 70 cycles/min

A carry handle applicator capable of speeds up to 70 cycles a minute has been announced by KHS Kisters.

The Innopack CSM works with pre-laminated handle material as standard although on-machine lamination of the handle materials, paper or plastic, is optionally available. Single or twin-lane models can be chosen.

Packs such as shrink-wrapped collations or cartons are pitched into the machine by a twin belt feeder using different speeds to create the small gaps required, while side-drive belts can also be fitted for handling lightweight or unstable items.

Adding handles: *Innopack CSM can be single or dual lane*

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New Machinery continues on page 78, after the Buyers' Guide.

APV BAKER

Bulk density and moistur measured automatically

An on-line system to measure bulk density and moisture automatically in dry, flowing products has been announced by APV Baker, newly appointed European distributor for the Aquadens unit made in the USA by III Sigma.

Aimed in particular at cereal, snack and petfood producers, the Aquadens unit detects changes as they occur, enabling corrections to be made immediately.

As a result, says APV Baker the cost of rejecting out of specification product is reduced, the labour costs and inaccuracy of hand sampling avoided and there is greater consistency in cooking and frying processes.

The system, which can be retrofitted, operates by taking a consistent measure of product directly from the process stream and establishing bulk density by weight and moisture by radio frequency. Measurements are repeated as often as every minute to give, in effect, real time analysis.

Upper and lower limits can be programmed into an existing PLC-based control system and operators alerted automatically of any deviation.

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