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OMRON

High performance in Safe machines

Technology & Trends

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12. Face recognition meets HMI
16. Fast data logging

New trends and developments in the market continue to have a major impact on the requirements of machine builders all over the world.

For instance legislation ensuring that manufacturers proactively implement preventative measures that help improve food safety and minimize recalls. Or -of course- safety, that has been a requirement for years, where its effective integration in the machine control is the new challenge that machine builders are facing. At the same time, final product customizations are becoming more and more demanding so the production industry requests higher and higher production speed and faster changeover.

These complex requirements and faster machines are creating the need to log more data to keep on top of running processes, or to meet compliance with supply-chain regulations.

In this issue, we show how we are addressing all these challenges. You can discover how safety can integrate seamlessly with advanced machine control and how fast and safe data logging can be easily achieved. You can read about the way your HMI will look in the future, it is already here for us, and about improved inspection and temperature control to increase your productivity. We show how some top machine builders are addressing their market challenges around the world.

Enabling high performance in safe machines is what it's all about.

John van Hooijdonk,
Marketing Manager Automation

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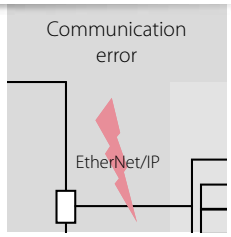

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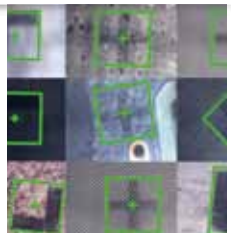

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Pre-compensating large increases or drops in jaw temperature.

Integrated Safety achieves the highest level of Productivity and Flexibility

The industrial automation processes, as well as the machines, are becoming increasingly dynamic. The need to increase productivity, flexibility, ergonomics and safety, as well as the need to reduce interruptions to production has become indispensable. All the technologies and components must easily inter-change information in order to fulfill these requirements. Omron's Sysmac safety solution was born to meet all the possible safety scenarios and requirements.

If the machine is in automatic mode and a mobile guard is opened, all the dangerous movements that may occur within a given area will be stopped by the safety circuit. On the contrary, when starting-up or adjusting the machine in manual mode, all mobile guards should be open in order to have free access to any given area. To avoid injuries, each dangerous movement must be reduced to a non-dangerous speed and monitored by safety components. On the other hand, if a very precise adjustment must be made using full speed or power, another working mode such as manual 100% speed, or semi-automatic is needed. Using this mode, mobile guards can be closed or opened depending on the needs of the adjustment. To control the quality of the production and to collect samples manually, a new operating mode must be implemented as well, and new safety functions must be designed. If you press an emergency stop pushbutton, the entire machine stops the dangerous movements.

The complexity of one single machine increases when the machine is linked to several machines under the same process line: a new machine is technically and legally formed, with all safety functions and exchange signals linked. This results in a large number of safety components attached to one single machine, but shared by many others.

NX Safety Control. Omron's integrated safety solution with Sysmac.

Easy becomes simple and simple is safe

The trends and tendencies towards integrated safety bring many technical advantages and only few disadvantages. For simple machines, the integrated safety reduces:

- The automation complexity, due to the easy inter-connections and dialogue among all the components.
- The number of components, due to all the different languages that merge and become a standard interface where all devices can enter dialogue safely.
- The reaction time and safety distances.
- The restart time after triggering a safety function.
- The unexpected manipulations.
- The programming time, due to the use of the same programming software environment and reusability of programs.
- The wiring and start-up time.
- The troubleshooting time due to the full diagnostic integration.

The integrated safety also increases:

- Machine or production line productivity.
- Machine modularity.
- Scalability on functions and complexity.
- Accuracy in all processes, because of fully integrated diagnostics.
- Diagnostics all the way from the wiring to the component.

When using integrated safety, the cost of the components is slightly higher, but it reduces exponentially the time spent during the planning, installation, programming, as well as during the set-up and start-up.

Easy for the Manufacturer	Easy for Initial Safety Inspection	Easy for the End User	Easy for Periodic Safety Inspections
Planning	Wiring	Use and understand	Detecting modifications
Design	Hardware I/O	Maintenance	Wiring
Machine construction	Logic combinations	Understand the errors	Hardware I/O
Installation	Documents	Modify (*)	Logic combination
Tests or checks		Upgrade or add functions(*)	Documents
Commissioning		Re-use the hardware (**)	
Documentation			

(*) If you are authorized

(**) Depending on the life time specifications

Safety Hardware

Any integrated safety system should accept signals from any kind of safety sensor as inputs. From a very basic electro-mechanical switch with potential free contacts to wear-free sensors using pulsed inputs or output signal switching device (OSSD), regardless of the detecting technology needed. All safety devices, either at Performance Level or Safety Integrated Level, can be contained in one single system. Omron's Sysmac safety solution is perfectly designed to do this.

INPUT

Detection Technology	Connection Technology
Mechanic	Electro-mechanic: free potential
Codified Magnetic Sensor	Electronic with potential(PNP)
Inductive Sensor	
Transponder Sensor (Single-Code, multi-Code)	
Pressure-sensitive Protective Equipment	Digital with Test Pulses (1ch)
Passive infrared protective devices	Digital with Test Pulses (1ch) delay/mirror feedback
Optoelectronic Sensor Direct Reflection	
Optoelectronic Sensor Diffuse Reflection	OSSD (2 channels)
Vision Based Protective Devices	Analog signal

The powerful combination of the programming software Sysmac Studio and the safety CPU, can manage up to 2MB of program load, or 1024 digital inputs/outputs in just one network. The Sysmac Studio also supports the IEC 61131-3 programming standard and the PLCopen Safety compatible function block and instructions. The integrated safety solution allows information sharing directly between the safety program and the standard program without extra work, just by defining the variables in the safety area. The sharing of non-safety signals in the safety program is also easy. The safety function blocks provided by Sysmac Studio, cover everything from a basic mathematical function, up to the safety functions such as emergency stop, guard or locking guard monitoring, electro-sensitive protective equipment (light curtains, scanners...), working mode selector, muting functions, special sensitive devices (single beam sensors, safety mats, bumpers, edges...), footswitch or 2hands, etc. You can even elaborate your own safety function blocks or macros and try them with the off-line simulator.

The troubleshooter integrates and monitors down to the last cable or movement, detecting shorts and cross shorts in the wiring, and checking all safety function blocks with all diagnostics, without effort for the programmer: you will have the same information as if you are in front of the machine.

Some technological trends, such as the safety Wi-Fi networks, are the only solution in some applications, but not applicable in many others. The Ethernet for Control Automation Technology (EtherCAT) is one of the fastest protocols that exists today, which includes the possibility of integrating safety, Fail Safe over EtherCAT (FSoE). Together, these two features offer many possibilities.

Any dangerous movement from a machine or production line can be stopped in three different ways:

- **Standard control system.** This system is driven by the control system (PLC).
- **Normal safety stops.** These stops are normally triggered by safety sensors: In these stops, the power is just reduced, decreased or controlled in a multi-operational, dynamic way, only from the local area where the guard or protective device is installed.
- **Emergency stop.** This stop is normally triggered by someone in a potentially dangerous situation. The machine must be stopped immediately no matter what the consequences may be.

Situations in which the dangerous movements must be stopped (with or without power):

The typical types of outputs of local or remotes that can be found in the integrated safety system, as well as the most dynamic motion safety functions integrated in the servo-drives or in the inverters, can be found in the following table. Safety in motion is one of the most important trends that is being developed by component manufacturers.

Situation	Control System	Safety System	Electrical		Mechanical		Pneumatic		Hydraulic	
	PLC (normally)	S-PLC normally integrated with the correspon-dent PL/ SIL	Control	Power	Electronic	Power	Electro-Valve	Compres-sor	Electro-Valve	Hydraulic Pump
Normal Situation	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Safety Situation Triggered by Guard or protective device	-	Yes	Yes	depends, normally the power is active	Yes	depends	Yes	depends, normally doesn't disconect the power	Yes	depends, normally doesn't disconect the power
Emergency Situation Triggered by Emergency Stop Push button	-	Yes	Yes	Yes, sometimes with small delay	Yes	Yes, some-times with few delay	Yes	Yes, nor-mally ex-haust the pipelines	Yes	Yes, normally driven the fluid to the tank

Omron's Sysmac safety solutions are based in two safety-CPUs and they are approved up to PL e or SIL 2, which can manage up to 128 safety node connections with a program capacity of 2 MB, with integrated I/O refreshing mode. Regarding inputs / outputs: there are also two models with 4 and 8 inputs and the can be used for any safety level, and we can provide a model with 2 outputs with 2 A. PNP and a 4 output model with 0.5 A.PNP. The relay output will come very soon.

OUTPUT

Classical-Physical	Over Safe-Network
Relay	Safe Acceleration Range
Single Channel	Safe Brake Control
Dual Channel (+;+)	Safe Break Test
Dual Channel Bipolar (+; -)	Safe Cam
	Safe Direction
	Safely-limited acceleration
	Safely-limited increment
	Safely-limited position
Transistors	Safely-limited Speed
Dual Channel (test pulses)	Safely-limit Torque
Dual Channel	Safe motor Temperature
Bipolar (+; -)	Safe Operating Stop
	Safe Stop 1
	Safe Stop 2
	Safe Speed Monitor
Analogue	Safe Speed Range
	Safe Torque Off
	Safe Torque Range
…	…

Jomet:
Customised packaging - on the fly

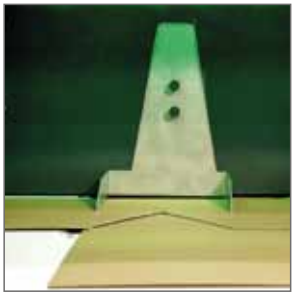
There was a time when many suppliers would use manual systems to create customised secondary packaging to protect products during the delivery process from distribution centre to customer or retail outlet. However, with volumes from online retailers increasing by up to 40 percent a year, hand-packing is no longer a viable option in most cases.

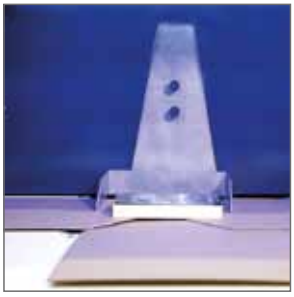
In recognition of this issue, Jomet, a Finnish company specialised in flexible automatic packing and palletizing systems, developed a solution which is designed to create packaging tailored precisely to an individual product or products, and to do so automatically. The concept is protected by several patents and has always relied on Omron technology. Its latest model benefits from the Sysmac automation platform.

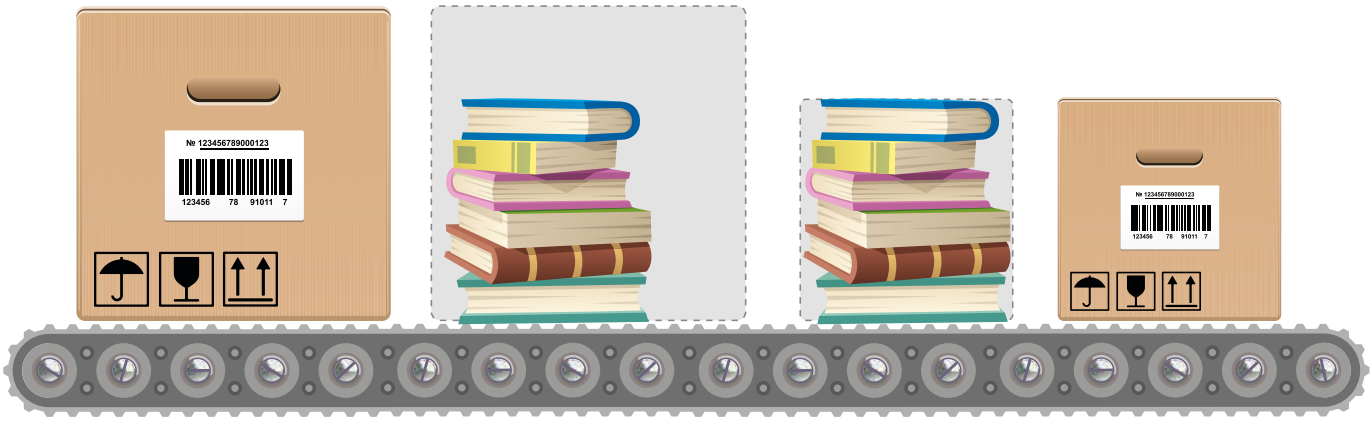
Previous systems for making secondary packaging would be set-up to make one type at a time: and setting-up for a new size could take half a day. Jomet uses servo technology, which enables all of the key machine parameters (movements, timing, positioning) to be set on the fly: essentially making the same adjustments that a human packer might do, but ten times faster - and much more accurately.

The original prototype was developed for a major online retailer in 2008, and it was so successful that the customer has installed several more machines over the past five years for distribution centres all over Europe. The technology works by first measuring each product, using vision sensors, and then setting up the machine, using servo technology, to create the pack round the product or products.

There are substantial savings in both material and transportation costs. The packaging material - typically







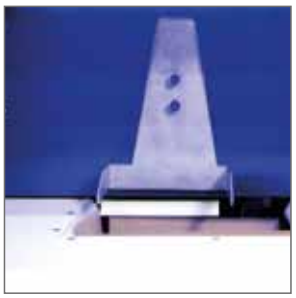
bi- or tri-wall corrugated board – is automatically cut to size and folded to size, with double-folds as necessary to provide protection. This cuts down the need for filling material, and minimises wastage. Bar-coded labels and delivery notes can be printed at the same time and included in the pack. And because the packaging is precisely tailored to the product, there is no shipping of empty space – just the product and its packaging.

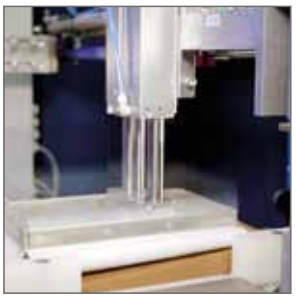
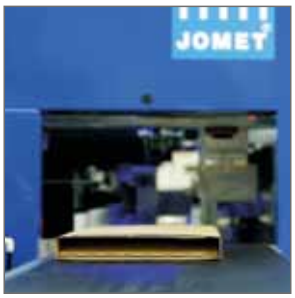
One of the many attractions of the system for multi-product online retailers is that it can be used to pack a number of items (for example, DVDs and books) in the same customised carton. These packs are created much more efficiently and cost-effectively than would ever be possible with manual packing, enabling retailers to output up to four times more products than was previously possible.

Since they developed the original prototype, Jomet has supplied such machines to a number of other online suppliers. Omron's Sysmac platform enables the technology to be easily adapted to suit the needs of individual end-users and product types. Programming and product development time are minimised, and new automation technology can be efficiently incorporated.

The B2C market – suppliers with online shops delivering products directly to customers – is continuing to grow, and each retailer has its own challenges to meet. Jomet's solution, with Omron's support, is able to answer their demands.

Watch the video:
industrial.omron.eu/jomet



Meeting (and beating) the China challenge

- In China since 1983
- 48 offices nationwide
- 40+ e-learning modules
- 20+ traditional learning course in 11 locations
- One-hour repair pick-up
- 24-hour parts replacement
- 60 hotline support staff
- 24/7 hotline support
- 100+ online technical product forums
- 350 R&D engineers & technicians

We all know that Chinese machinery market is from several years a reality that European and American machine builders cannot ignore. Where the lower end market in China has a strong local predominance, the local market for higher performance machines is still highly dominated by western import. So, where the local builders are now pushing to find further growth opportunities in India and in other emerging markets, the European ones are still enjoying a healthy growth, but not without challenges.

A growing demand for high-end machines

There is a growing demand in China for more sophisticated equipment, where European manufacturers can demonstrate decades of experience. Exploiting this demand has its own complications. For a start, European-standard machines will have to be localised to suit the specific demands and requirements of Chinese end users. This must be handled quickly and efficiently, and calls for sensitivity and a clear understanding of the local market and how it operates.

Most high-end European machine makers began their foray into China by relying on their western workforce to get production moving and to handle the issues of localisation and commissioning. Some manufacturers still rely on existing design and production facilities but others have taken the step to produce locally.

However, as many western manufacturers have discovered, establishing a local manufacturing base has many pitfalls, and going it alone can be difficult and expensive. For a start, there is the need to source specialised parts

and systems – which might not be available globally – at a cost effective price. Regular and effective training of local staff is also necessary, as is the need to establish good local engineering expertise. Fast, reliable and effective commissioning is always important, as is the need for effective aftercare.

It's also the case that some facilities could simply be too expensive to establish locally. R&D departments, test laboratories and similar technical functions make a big difference to the process of localisation, but they also call for considerable investment. It makes good business sense to look for other ways of providing these functions, without the need to make unsustainable commitments.

Long-term support is also an issue. Chinese end users are no different from those in any other market in looking for consistent uptime through the working life of the machine. This calls for a reliable source of good-quality replacement parts that can be delivered and fitted quickly; skilled, efficient and local technical support; and repair facilities that can minimise downtime by identifying issues and fixing them before they become major problems.

Work with companies who know and understand the market

All these complex issues need to be addressed, and the right solutions found. So what to do? Give up and do something else instead?

Well, no. Every business that has become successfully established in the Chinese market knows that choosing the right business partners can solve most of these issues. And for high-end machine builders, reassurance will come from working with an established automation supplier who can provide all the support needed.

This support will come in a number of ways. For a start, advanced training facilities and a nationwide network of offices will bring staff up-to-speed quickly, ensuring rapid start-up, effective localisation and a reduced time-to-market. Automation partners should also have skilled and knowledgeable engineering teams, fast local and cost-effective availability of parts, and field service staff who know the importance of preventative maintenance.

The Chinese market is not an easy one to penetrate, but it's not impossible. With the right planning and - vitally – the right business partners, the opportunities for European machine makers are considerable - and growing.

Omron China wins Best Customer Service awards

In the "2012-2013 Best Customer Service in China" assessment program, organised by the China Information Industry Association and the China Association of Trade in Services, Omron Automation (China) Company Ltd won three separate awards (Award for China's Best Service Center, China Best Service Award and an award for China's Best Customer Service Manager). The selection process lasted eight months and used mystery clients to assess the way in which participating companies handled a range of unannounced contacts. The awards were presented to Omron China's Vice-President Customer Service Center Long Xu Weihua (centre) pictured with two of his award-winning staff representatives.

Commenting on the awards, Mr. Long said that these are the industry standards for customer service, and he was honoured to receive them on behalf of Omron. "It shows that Omron understands the importance of customer support, in addition to product quality, service and the competitiveness of our clients," he said.

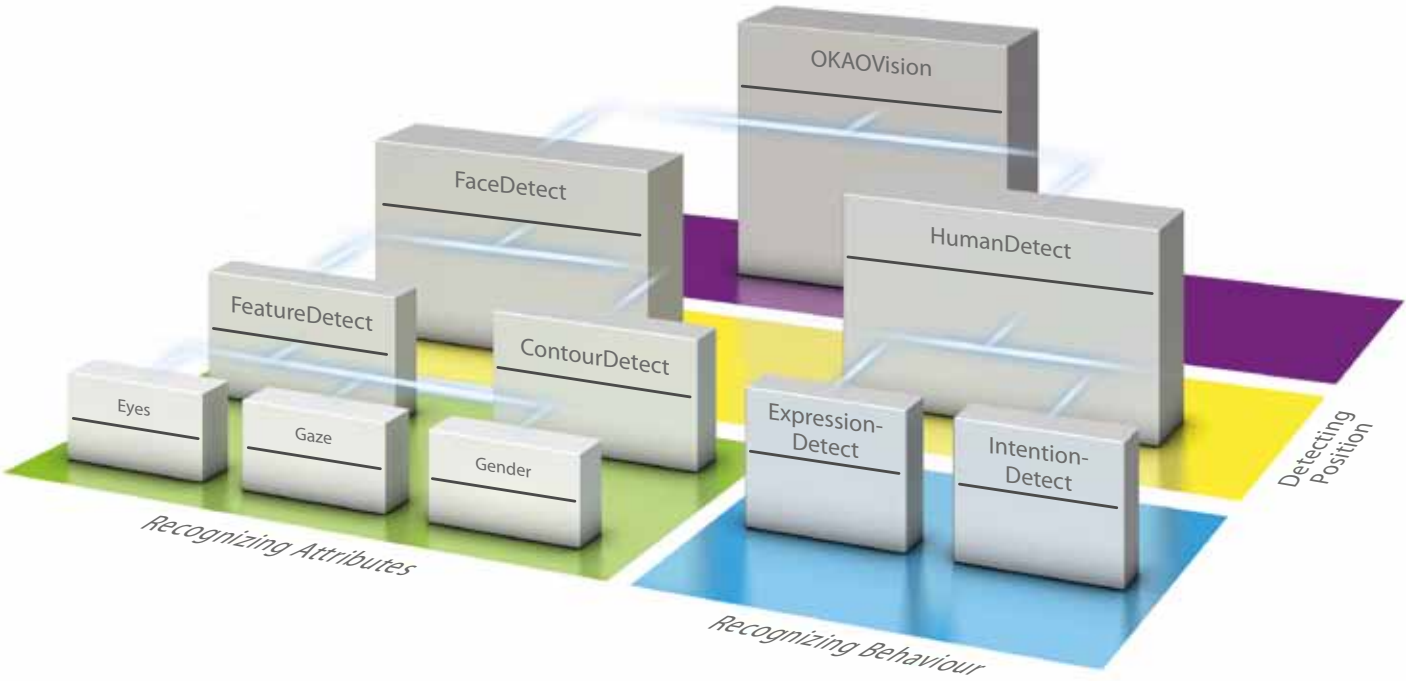
Vision Meets HMI

HELPING MACHINES TO THINK INTELLIGENTLY AND REACT QUICKLY

To enable its customers to make better, faster, safe machines, Omron is increasingly using ideas initially developed for the consumer market. OKAO face-recognition technology, familiar to smartphone and digital-camera users, will soon be used to protect machines from unauthorised access or dangerous working practices. New technologies are dramatically changing the way we will interact with machines. As a result, the machine interface will provide invaluable information to everyone involved in machine use, from operators to support staff, and from machine makers to end users.

Recently, Omron's Industrial Automation Division has been working closely with a team of experts from Omron on technology known as OKAO (literally 'Face vision' in Japanese). OKAO is already used worldwide in smartphones and cameras to take the perfect picture when the subject is smiling.

It's an extraordinary example of Omron innovation because OKAO can recognize, analyse and process the facial features of anyone in any situation, assessing factors such as gender and emotional state. It can simulate human understanding by detecting positional changes and analyzing behaviour and even intentions - for example by determining the direction of gaze and recognizing body movements such as hand gestures.



OKAO works by looking at facial features such as the eyes, and their relationship with adjacent features such as the nose or mouth. Using patented statistical analysis techniques and 'training' the system using huge sample numbers (many millions have been sampled to date), it is possible to fit a 2D model to a 3D facial shape and create a reliable 'identity' for a particular face.

Boost safety and prevent unauthorised machine access

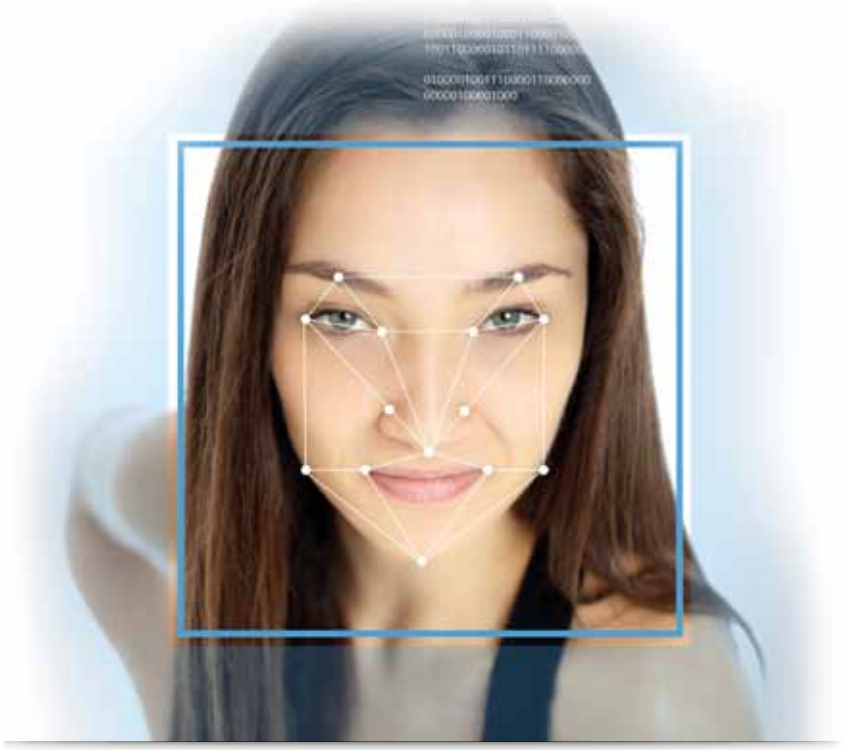
Developments like OKAO bring new ways for users to interact with machines. For example, OKAO could help to boost safety and prevent tampering by identifying someone from a distance and verifying them as a person who is (or is not) allowed to work on the machine. In the automation environment, OKAO could enable a machine to decide how close an unauthorised person is allowed to come before, say, switching off moving parts.

OKAO could go even further. Today's HMIs incorporate touch screens, so an engineer or operator must be close-by to operate them, and passwords must be entered manually: why not have the machine recognise who is using it? This would ensure that only an accredited person is allowed to change configurations or access production data.

OKAO could even respond to body movements, such as hand gestures, from a distance. If an engineer were unable to access the HMI directly, this could save valuable time and get the machine back online more quickly.

Redefining our relationship with machines

There are enormous possibilities with OKAO technology, and Omron is keen to bring them to the industrial automation market. But it is not the only way in which our relationship with machines will be redefined. Take, for example, the use of data. Stand almost anywhere in the world today and you will probably see someone using a smart phone, digital tablet, or media player. They are using social media or the internet to keep up to date,



processing their emails, managing their finances and of course making the occasional telephone call. In short, they are using data.

This is the digital world, and it has dramatically changed how, when, where and why human beings interact with devices. It is perhaps no surprise that these technologies are starting to have a major impact on the requirements of machine builders. Their core objectives have not changed: build a machine that is robust and reliable, and that creates a product as efficiently as possible. These goals will never change, but now technology is allowing new and innovative ways for users to interact with their machines.

Better, safer machines – through improved data access

At Omron, we are developing the future, and adapting the changing role of the HMI to bring new value to machines. Tomorrow's world is more focused on the 'Machine Interface' as a gateway to machine data – from anywhere in the world. The primary task of the HMI is increasingly one of data transformation, making the machine data understandable to a whole variety of different consumers. Whether that consumer is an operator in front of the machine, an engineer on the other side of the world, or an ERP system, the role of the Machine Interface is to transform the data and make it accessible when needed.

Accessing and using more data will help designers to create more efficient machines, end-users to maintain increased throughput with lower wastage, and machine makers to deliver better lifetime support. As you will read in this issue, Omron's objective is to help deliver this promise of higher performance in safer, faster, more reliable machines.

Trends in short

No production slow-down at changeover

Italian packaging machine specialist, Clever, recently developed a heat-shrink sleeve applicator using a film cutter on electronic cams. Compared to conventional solutions using mechanical cams, this electronic architecture allows operators to change product and format without reducing production speed, by setting the pitch of the feed screw and the length of the film. Omron NJ-Series Machine Controller enables operators to modify both the label application phase on the bottles as well as the cutting phase. Importantly, PID internal learning inside the PLC is used to adjust all parameters automatically.

industrial.omron.eu/clever

Entering the high-end market in Europe

Beta-Pak Otomatik Paketleme, Turkey's leading packaging-machine maker, export its high-quality thermoforming machines to 35 countries across the Middle East and North Africa and is now expanding its business into Western Europe.

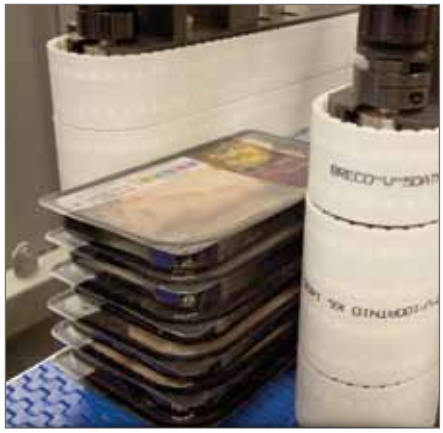
Efficiency and reliability are key characteristics for all packaging equipment, but particularly for those used in the food industry, where unplanned downtime can lead to products being spoiled and/or wasted. With an extensive market outside of Turkey, Beta-Pak's customers look for machines that are both globally available and well supported.

industrial.omron.eu/beta-pak

Meeting needs of demanding customers

The Converging Solutions Pack Stacker is widely used in the UK food industry for automatic stacking of pre-formed packs. When the company wanted to compete in non-food markets and other countries, they needed to make the machine do more, and do it faster. The partnership with Omron has enabled ConSol to develop their latest stacker with increased functionality, faster set-up, greater flexibility, and improved diagnostics. Modular construction, allied to Omron's "plug-and-play" technology, reduces build time and optimises reliability to maintain machine uptime.

industrial.omron.eu/converging_solutions



Harnessing the power of data

to create faster, safer machines

It's a familiar saying: "Knowledge is power". But this familiarity does not devalue the fundamental truth of the axiom: we need knowledge to make decisions, and the more we know, the better our decisions will be. Omron's new data-logging system is designed to ensure that machine data can be recorded accurately, comprehensively and safely, and fully integrated into an organisation's database management process. The result will provide information needed to optimise production, improve quality and increase machine uptime.

Data from machine operation has the potential to be a powerful management resource. However, fulfilling that potential requires data handling systems that can control, manage and analyse the information efficiently and effectively. For OEMs and end users, the ability to harness the power of high-quality machine data can provide deep insights into production efficiency, enabling changes to be made that are based on practical evidence.

Data can be used to analyse process management or create audit logs; it can be employed to monitor equipment to help plan replacements or preventative maintenance programmes; it can provide a measure of production efficiency; it can be used to determine profitability or cost-effectiveness over different runs, batches or shifts; and it can be a vital decision-making tool in future planning. It is also increasingly necessary to show compliance with supply-chain regulations.

A compact and cost effective way to log data

However, information about machine operation is only really valuable if the data is valid, complete and protected from tampering, which calls for a robust and efficient data-logging solution. Omron has answered this call by integrating into the Sysmac NJ controller a compact, off-the-shelf and cost-effective way to log data from high speed machines working on synchronised operations in an industrial environment.

The data-logging solution can record everything needed to analyse production processes and ensure quality on all levels. It's a truly comprehensive system, where all data can be simultaneously logged through the same unit, from passive sensor values to smart data and internal control variables. This enables users to drill down to the root causes of incidents, to analyze failures and machine downtime, and to optimize energy and materials use. It also provides valuable input for statistical process control, Pareto analysis, or any other quality-management tool.

The database-connection software is incorporated in the Sysmac NJ controller. No other hardware or middleware is needed, and this direct connection ensures that data transfer is both fast and secure. This security is

further enhanced by username/passcode protection for connecting to the database server, and the data is encrypted during transfer. In addition, if the connection to the database server is interrupted for some reason, the data is spooled on intermediate storage in the controller, ready for transfer once the server connection is restored.

As with everything else on the Sysmac platform, programming the database connection in the NJ machine controller is really easy. Standard function blocks are available for control, status reporting and transfer of the data, and once it's set up, the database connection can be constantly monitored.

Traceability and compliance

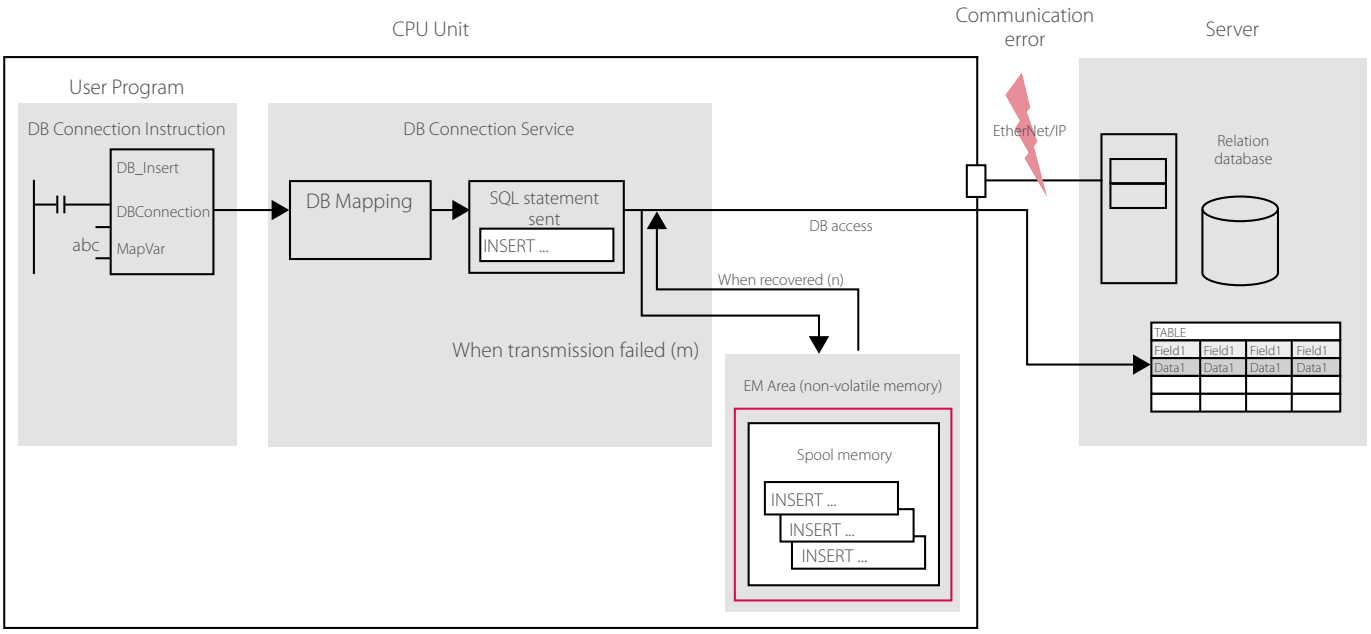
Traceability has become a key issue in recent years. The EU's Good Manufacturing Processes Directive and the USA's Food and Drug Administration (FDA) 21 CFR Regulations both lay down strict guidelines on maintaining process records that are trustworthy and secure, and that provide a guarantee of acceptable and repeatable quality. The Omron data-logging system provides an easy-to-use, efficient and convenient way to help you to comply with all these requirements.

Fully integrated

The value of machine data can only be maximised if it is widely available to all relevant stakeholders. Different departments and teams can use the information – either on its own or with other data – for process improvement and analysis, management reporting, and auditing.This integration into enterprise systems is easily achieved by an organisation's own IT department, using standard technologies. There's no need for specialised reprogramming.

Omron data-logging is an industry first, designed to help machine-makers, OEMs and end users to set up a formal system for recording machine data and storing it securely. The system creates an accurate and reliable audit trail of what has happened, over time, on a production line. By integrating machine data into an organisation's wider database management, the Omron solution delivers major benefits to companies who want to exploit the full potential of this resource.

industrial.omron.eu/regulations_pharma_f_b



Spooling function - In case of communication error the data will automatically be stored in the spool buffer.

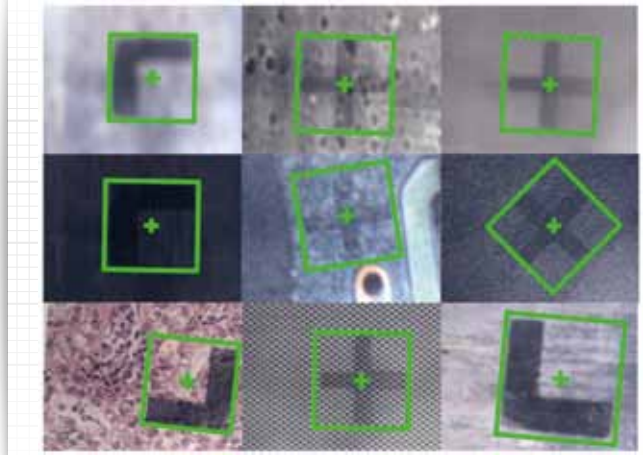
Shape Recognition

New image processing methods enable more than 10x faster detection during packaging inspection

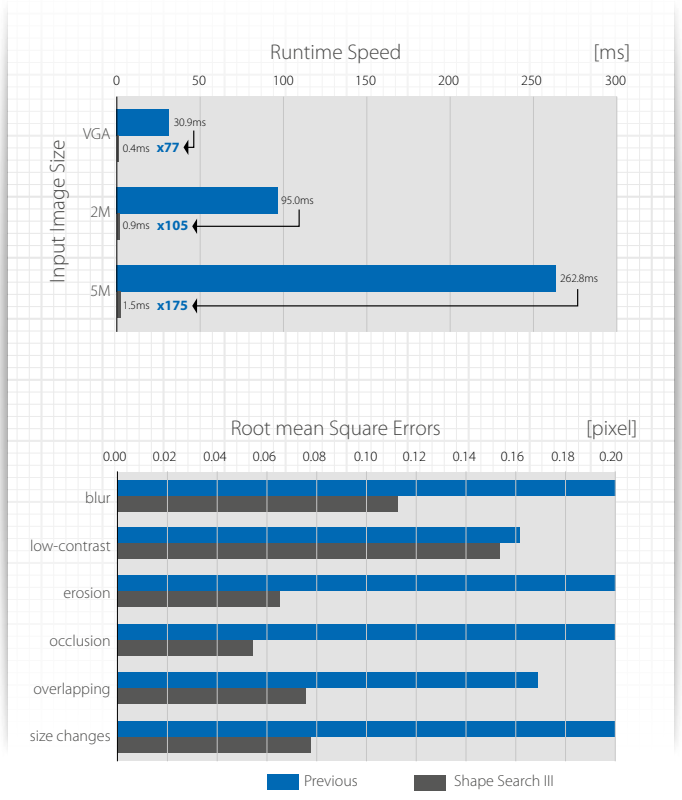
High consumer expectations regarding information on food products, pharmaceuticals and non-food products, as well as new legal requirements, mean that producers have a growing need for inspection solutions that check whether this information has been applied correctly. In addition to final inspections, these producers are increasingly using in-line inspections at critical points in the corresponding processing steps.

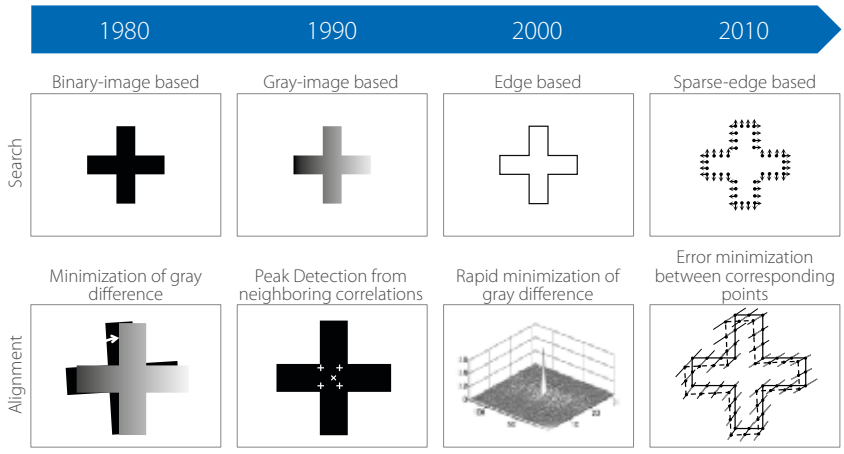
Image processing for high speed packaging processes often a compromise between speed and precision

The inspection of exterior features of packaging, as well as printed information on labels or packaging, plays a central role in this process. These are the first elements that consumers see and are often a decisive factor in their purchasing decision. They can even have legal consequences. However, increasing cost pressures in production mean that faster processing speeds are being used. For many inspection systems this represents a major challenge when it comes to precise detection of objects, including possible special cases in variable environmental conditions. The necessary computing power is often high and is associated with a reduction in processing speeds.



By using new image processing algorithms (e.g., edge-based sparse features, variation absorbing templates etc.) and ultra-fast, parallel hardware architecture, the new FH optical inspection system from Omron can achieve detection speeds that are more than 10x faster than conventional inspection systems. Compared to previous algorithms, it can even achieve 100x faster speeds while also increasing detection quality.





Sparse edge detection algorithm solves problems of previous image processing algorithms

Each decade since the 1980s has seen a breakthrough in image processing algorithms for object detection.
In the 1980s, binary image based algorithms enabled relatively rapid object detection. This rapid algorithm was adapted to the very low computing power available, but demonstrated sensitivity to noise, lighting changes, shadowing, low contrasts and other conditions.
By the 1990s, hardware speeds were increasing rapidly, allowing for a more accurate analysis of the image gray scale value while reducing the number of problems encountered at low contrasts.
In the 2000s, edge-based algorithms brought about improvements with regard to lighting changes and shadowing, though these algorithms still had disadvantages when it came to blurring and low contrasts.
The new sparse edge detection algorithm takes the information that is used and reduces it to clearly identifiable and representative points.
This eliminates the possibility of errors occurring while also achieving significant improvements in speed.

Variation-absorbing method increases stability and speed through variation prognosis

In conventional inspection systems, minor deviations in the position of objects, e.g., due to a vibrating conveyor belt, can inhibit error-free or rapid processing of image information. Any countermeasures taken in the software to compensate for these errors may significantly reduce computing power, thereby reducing processing speeds. Often, a compromise must be reached between reliability and speed.
The new variation-absorbing method (patent pending) predicts possible variations in the representative points of the tracked objects. These variations are summarized using an intelligent clustering process. An analysis of these clusters reduces detection errors, while the processing speed remains high due to the low memory usage. This ensures that high-speed image processing can be completed with ten times the level of precision (e.g., by comparing the root mean square error).

Smart visualization method enables intuitive image optimization even for inexperienced users

The criteria for achieving an object image that is as clear, stable and as simple as possible to process, are extremely complex. In the past, an improvement in this original image for processing by inspection systems was often judged by trial and error or by using expertise built up over many years. The new visualization and image optimization concept of the Shape Search III software in the FH inspection system from Omron makes it easy to improve the image, even for inexperienced users.
The software uses an intelligent approach that links the factors that influence the image and presents them to the user in such a way that intuitive optimization can be achieved.

industrial.omron.eu/fh

Direct Power Control

Maximising speed and quality in each process stage on FFS machines

Growing populations and greater disposable incomes have resulted in increasing consumer demands for improved product availability, and at lower cost. This in turn has led directly to pressure on machine makers to create equipment that will pack more products, and deliver them faster. On Form, Fill and Seal machines, widely used in the food and pharmaceutical sectors, temperature control is one of the key influences on both the speed and quality of delivery – which is where Omron's 2-PID and Direct Power Control technologies can make a real difference.

Form, Fill and Seal (FFS) machines are widely used for high-speed packaging of products such as nuts, confectionary and other foodstuffs, as well as for pharmaceuticals. This type of machine offers a number of benefits, of which one of the most important is the system's versatility. FFS machines can be used for a very wide range of products, and the packaging material – usually flexible foil or film, fed from a roll – can be quickly switched, which enables pack changes to be easily made. This is particularly important with products such as snacks, where the same line is often used to package many different varieties.

Precise temperature control is essential

The packaging material is formed round the product and sealed using a heated jaw that clamps on to the foil or film to create a high-quality closure. Control of this sealing process is vitally important in optimising the speed and quality needed to achieve high throughput and minimise product or material wastage.
Three factors impact on this: the jaw closing-pressure; the timing; and the temperature of the sealing jaw. Motion control systems take care of the pressure and timing, but temperature control is equally important. If the jaw temperature is 2°C more than the set-point, the seal could burn; 2°C too low and the seal could be either inadequate or non-existent. If wastage and damage is to be prevented, precisely the correct temperature must be achieved right from the start of production, and maintained throughout the production process.

An added complication is that the quality of the seal is affected not only by the temperature of the jaw but by the ambient conditions, the temperatures of the packaging material, and the product itself. For example, products that are wet, chilled or frozen can cool the film or foil, which can cause the seal to fail unless compensating heat is applied. One option is to design machines with bigger sealing jaws, to retain heat for longer. Another is to pre-heat the foil, although this is not always possible or permissible.

A further consideration is that, during the production run, the film absorbs heat from the jaw at each seal, causing a slight fall in temperature. This means that the jaw needs to be reheated before the next seal can be completed (see figure 1).

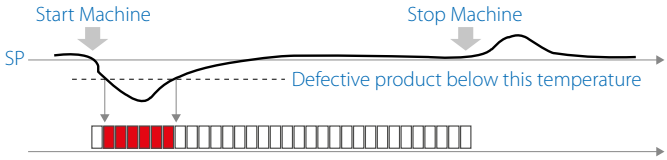


Figure-1: Bad seal at startup

Run at full speed from the start

Further issues occur when production is paused or stopped for some reason – for example to change product or packaging type. At re-start this can cause the jaw temperature to fall away rapidly, and inadequate seals will result unless this can be recovered immediately – see figure 1. On the other hand, there will also be problems if there is a short stop the jaw becomes overheated. The ideal is to maintain a consistent temperature at all times. The only guaranteed solution is to control precisely the temperature of the sealing jaw at each stage of the operation. Omron's 2-PID algorithm has been developed to ensure that during a production run the jaw temperature quickly recovers after each closure, so that it is maintained at the optimum level each time a seal is made.

This is possible because the unique auto-tune facility built into Omron's 2-PID temperature control will optimise the system for a fast-disturbance process, such as sealing on an FFS machine. This brings the seal-jaw temperature back to set value almost instantly, ready for the next closure.

That takes care of the production run, but when a fast-moving FFS machine moves from production to idle and back again, the balance in the PID control loop is disturbed. This causes a drop in temperature which could result in incorrectly sealed packages, and consequent material and/or product wastage.

The optimum is fast and faultless production

To achieve the optimum of fast and faultless production from the start, the seal-jaw is pre-compensated for any drop in temperature. This is achieved using Omron's Direct Power Control (DPC) technology, which is embedded into the Sysmac NJ Series machine controller. The DPC function block is loaded with the PID parameters and other information such as machine and timing values, which enables the seal-temperature and timing profiles to be calculated using the machine controller (see figure 2).

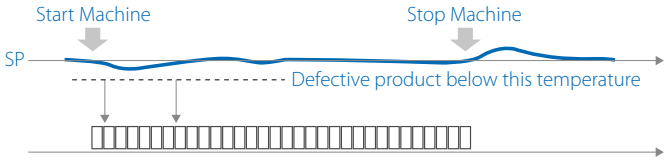


Figure-2: Result when using DPC, no bad sealing so good packs right from the start

Thus, in brief, the PID/auto-tuning system compensates for temperature variations during the production run, but once the machine stops or needs to restart, DPC takes over, compensating for the larger increases or drops in jaw temperature. For full information on how this works, download the Omron White Paper about the DPC Function Block technology.

industrial.omron.eu/direct_power_control

The Sysmac NJ machine controller, using the DPC function block technology, integrates temperature control, timing and jaw pressure with the running of the FFS machine, so that wastage resulting from poor seal-quality should be eliminated. Moreover, because the DPC technology compensates for heat-loss, there is no need for bigger sealing jaws: machines can be made with lighter and less expensive jaws, which in turn reduces energy use. For systems integrators, machine makers and the end-user, the business benefits are clear – and readily available.

ENTREC
PARTNERS IN PACKAGING

Entrec: FFS specialists now using Sysmac

Belgian manufacturer Entrec specialises in the sale and rental of FFS machines, especially retro-fitting flow-wrap systems to existing lines. Omron has been working with Entrec, showing how to integrate the Sysmac platform into their flow-wrap FFS machines. Sysmac provides a robust machine control system that will work with any third-party device, so that Entrec could implement the platform easily. And because the necessary technologies (like Function Blocks and 2-PID) are already incorporated, stand-alone temperature controllers are unnecessary, which was particularly interesting to Entrec.

industrial.omron.eu/entrec

Technology in short

A set of solutions that hit the target

Whatever type of automated machinery you are specialized in, you know that there are many ways to innovate. You are already aware that there are many possible areas for improvement. But where do you start? Where do you focus your efforts? Where can you make the biggest difference with the least amount of effort? By identifying the answers in specific industries we developed the 'targeted technologies' concept. It's a way of thinking about technology, according to our customers' most pressing needs. The result is a set of solutions that make immediate impact on the core of our customers' businesses: industrial.omron.eu/technologies.

SYSMAC always in control

361°

Sysmac: the all-in-one platform

Sysmac is the latest machine automation platform from Omron with integration throughout. It is a powerful and robust automation platform with a new machine automation controller (Sysmac NJ), that integrates motion, sequencing, networking and vision inspection, a new software (Sysmac Studio), that includes configuration, programming, simulation and monitoring and a fast machine network (EtherCAT) to control motion, vision, sensors and actuators.

361: The perfect match

When it comes to sensors and components, we know that our customers all have different needs. That's why our product development in this area is driven by the 361° Approach. It produces product families that offer a total all-round choice. From quality products suited to standard environments to specialist devices that can handle extremes. The 361° Approach not only provides a complete all-round offer without gaps, it also puts you at the very centre of the product selection process.

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