

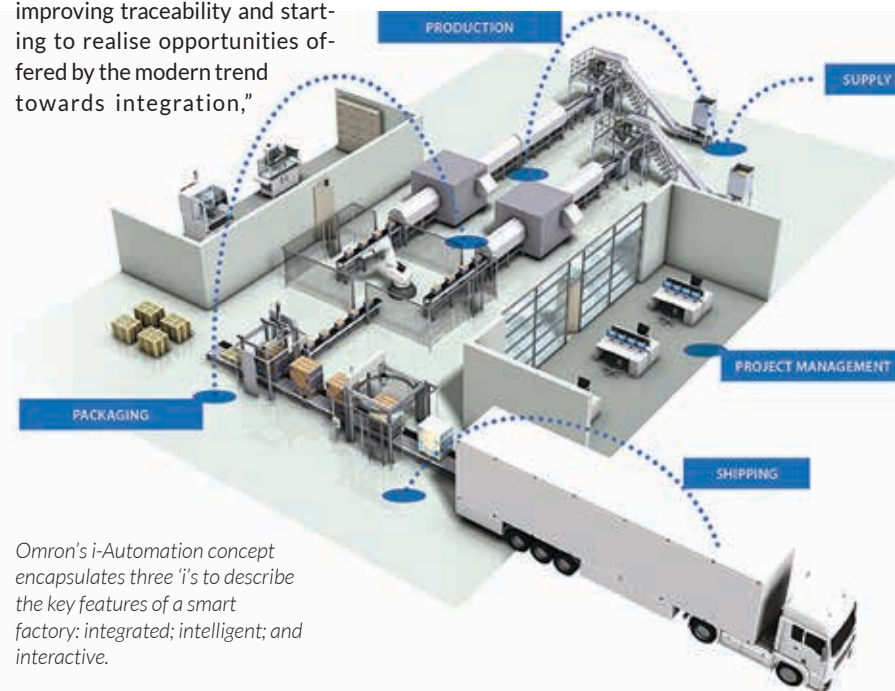


i-Automation, OEE and the smart connected factory

Talking at Omron's Innovation Conference at the CSIR earlier this year, Driaan Coetzer, field application engineer and product manager for control and visualisation, opened the proceedings with a talk about i-Automation, overall equipment effectiveness (OEE) and Omron's vision for the smart factory.

Welcoming delegates at Omron's Innovation Conference, Victor Marques, Omron's country general manager for South Africa and sub-Saharan Africa introduced some of Omron's new developments: the new Q2A series VSDs; the FQ range of smart vision systems for quality inspection; the NX1 series of machine automation controllers; the TM5/12/14 robot series being developed in alliance with Techman (TM) Robotics to foster machine-human collaboration; and Forpheus, a robot designed to play ping pong against all-ability humans – it can adjust the difficulty of its return shot based on the predicted skill of its human opponent. Introducing Driaan Coetzer, Marques says that this control and visualisation specialist has been with the company since 2013 and sets out to "implement solutions that exceed customer expectations".

"With respect to industrial automation, big data, smart factories and the IIoT, today we hope to focus attention on what customers really need. We will be talking about our world-first AR motion controller and about how to improve overall equipment effectiveness (OEE), reduce waste and downtime, improving traceability and starting to realise opportunities offered by the modern trend towards integration."



Omron's i-Automation concept encapsulates three 'i's to describe the key features of a smart factory: integrated; intelligent; and interactive.

says Marques before inviting Driaan Coetzer to the podium.

What is a smart factory? Driaan Coetzer

"I am here to talk about why industry is talking about smart factories, connected manufacturing and overall equipment efficiency," begins Coetzer. "What is a smart factory?" he asks.

"Everything we have been doing since the 1970s falls under Industry 3.0. But now the talk is of a fourth industrial revolution, Industry 4.0. Do people actually want this? Or are all of us simply looking for better ways of doing what we have always done?" he asks.

Omron Industrial Automation has come up with the term i-Automation to help simplify and clarify the new technologies and capabilities associated with smart factories. "This phrase includes three 'i's that describe the key features of the smart factory: integrated; intelligent; and interactive. These are the three pillars on which we believe smart factories will be built," Coetzer tells us.

"Are they talking about products? In this complex environment, nobody can claim to have the one solution anymore. Omron has



Omron's FQ range of smart vision systems embeds Ethernet and EtherCAT for ease of integration into any environment and they include an incremental encoder for easy tracking and calibration.

produced the very first controller with embedded artificial intelligence (AI), but even this is only a small part of the bigger smart factory picture," Coetzer notes.

"This industrial revolution is pushing us into providing more than just smart products, more than automated production lines and more than intelligent SCADA systems that can monitor and log progress being made. The smart factory is much bigger than the sum of all of its individual equipment systems," he notes.

The first 'i', integration, is about the connection between the automated production processes and the IT systems, getting information from the shop floor and into 'the cloud' – which is really just a server somewhere – where it can be processed and analysed. The results can then be fed back, either directly into production processes or to operation managers – and it can also be used in a host of benchmarking and reporting processes," Coetzer explains.

"Essentially, the integration 'i' is about integrating machine automation and corporate IT, generating and collecting large amounts of relevant, real-time data for meaningful and useful analysis," he says.

He then adds a more formal definition for the smart factory context: the seamless

integration of technologies through advanced control and data to improve machine and process performance and accuracy.

"The second 'i' in i-Automation is for intelligent and I have already commented on the recent release of our new controller, the first with embedded artificial intelligence," Coetzer continues. "Intelligence suggests that the way we do things is no longer reactive. By using data histories of the past, it becomes possible to be predictive and proactive in the way we respond to events in the factory."

Smart factories also demonstrate the use of intelligent data analysis and evaluation capabilities to realise predictive maintenance, process improvements, customisation, serialisation, traceability and energy efficiency, along with waste reduction. We have the millennial generation to thank for the last point: they are very concerned about the environment, the better management of waste and the reduced use of scarce resources. Waste is becoming a huge modern business area," he suggests.

Interactive is Omron's third 'i' and it emphasises machine-to-human interactions. "Omron's new robot collaboration with TM is producing robots such as our new TM5/12/14, which enables machines to work together with people safely and productively. Enhancing the interaction between humans and machines combines the intuitive, flexible, knowledgeable and adaptive capabilities of humans with the repeatability, accuracy, power, speed, autonomy and productivity of machines. This all comes together in the integrated collaborative factory. That is what we are striving for," Coetzer argues.

"Machines can also be collaboratively connected to other machines to maximise production efficiencies and minimise bottlenecking, for example. Built in intelligence enables them to make autonomous and cooperative decisions about how to best satisfy production requirements in given circumstances," he explains.

After showing a video of how i-Automation can all come together in a smart factory, he says that the goal is predictive innovative solutions: "Like a little child in a crèche, before the machine wets its pants, it will tell you it needs to be taken to the toilet," Coetzer jokes.

Omron function blocks attached to its controllers are already able to monitor the performance and condition of a manufacturing machine. "Built in diagnostics prevent or significantly reduce the risk of unplanned shutdowns. They also enable the machine to communicate with the HMI and SCADA system about any faults and can display perfor-

mance data such as uptime and throughput.

"From a marketing perspective, we used to always try to push our manufactured products into the market. Now, the customer can directly dictate what a factory makes and what happens on a factory's production lines. The customer can select how and what is made, the specifics of the colour and his or her preferred accessories – and this is already happening on most of our motorcar assembly lines," he points out.

"This is what a smart factory is all about," he says.

Overall equipment effectiveness: OEE

"Do South African companies know what their production efficiency is and how smart technology might impact that production efficiency? Improving this value is a key objective of modern smart factory technology," Coetzer suggests.

"Very simply put, OEE is about analysing and improving in three key areas: machine performance, machine availability and product quality. And it is not new. The measurement algorithms for the assessment of OEE were developed back in 1988 by a Japanese gentlemen called Seiichi Nakajima," he informs delegates.

"OEE reveals the hidden costs in a manufacturing line. By evaluating the availability loss through planned and unplanned stops; performance loss compared to maximum possible throughput; and the quality loss, through rejects or rework costs of finished products," explains Coetzer.

From the data mined by an i-Automated system, changeovers can be optimised, downtime reduced, throughput maximised and reject-rates minimised.

"But an expensive IIoT gateway is not necessary to implement an OEE improvement strategy. Omron has a controller that can help production lines to implement OEE very simply," he reveals, adding that there is no need to develop complex mathematical algorithms or to analyse big data in the cloud to determine what the overall equipment efficiency is and how to improve it.

Omron's simple OEE solution resides in its NX1 two-in-one multi-tasking controller, which provides accurate real time motion control, along with quality inspection and safety monitoring, all integrated and aligned.

"The NX1 gives direct access to production data, enabling OEE to be easily determined and assets to be managed in an effective way," Coetzer assures. "It offers a reliable and all-in-one IIoT connectivity, has variable data storage and comes with OPC-UA and



Omron's new robot partnership with TM is producing robots such as the new TM5/12/14 to enable machines to work collaboratively with people.

SQL database connectivity option," he adds. Above all, it makes implementing an OEE improvement programme very easy.

On reducing quality losses, Coetzer cites Omron's vision inspection systems, camera's for online quality and track and trace inspections. "Vision solutions are ideal for where there is a need for repetitive and precise quality checking at high speed and on the fly, all of which is very difficult for humans to do consistently. We have systems that use facial recognition-type software to monitor and record product completeness and accuracy at high speed, along with systems that can check the accuracy of labelling.

"The quick response of these systems can alert operators to problems very quickly, so that the cause can be rectified before large numbers of rejects are produced," he says.

Omron's i-Automation portfolio of control, sensing and thinking technologies can already be used to create the smart connected factory being so widely talked about, without the necessity for expensive gateways. "IIoT data and other KPIs can be generated and used to create key performance data, which can then be visualised and analysed. And once an issue has been identified, implementing a solution for improved OEE is often very simple," Coetzer concludes. □