BECKHOFF New Automation Technology

Designing the future mine

How mining and process companies can harness the best of automation technology

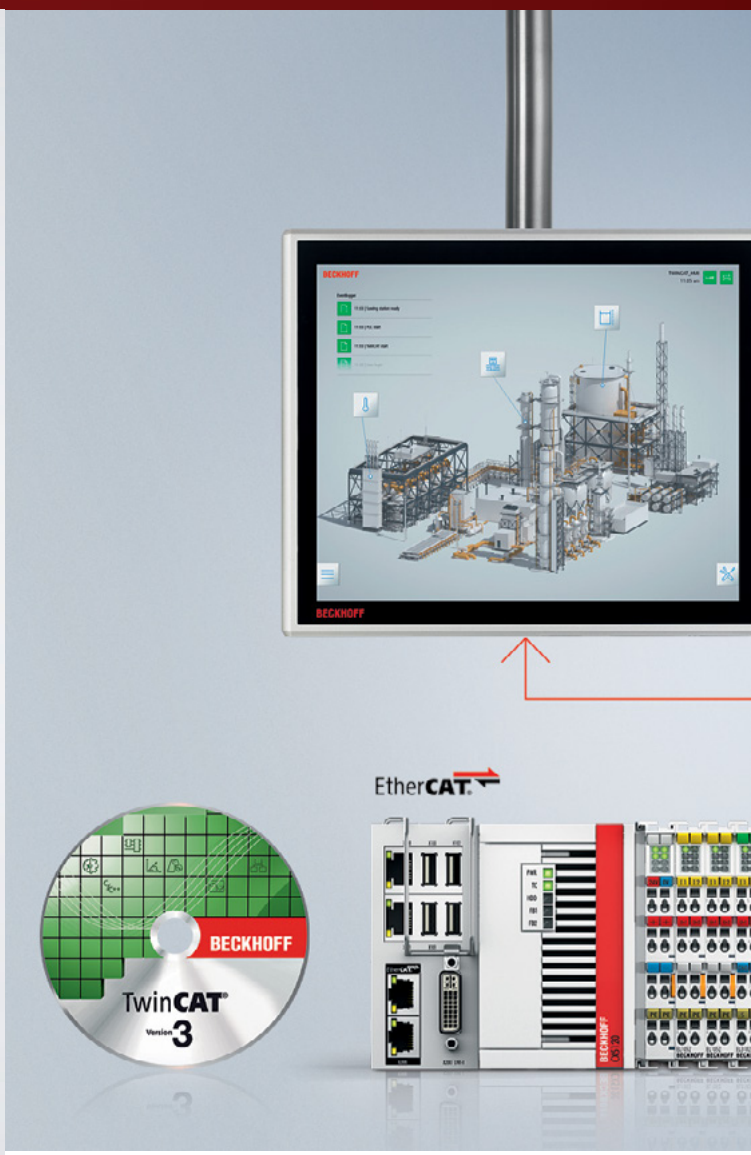
Introduction

Automation has been widely used in all facets of mining for decades. These technologies, however, have generally been adopted by mining operations one area at a time – in other words, in silos. According to Nick Psahoulias, the full benefits of automation will only be realized when these technologies are integrated through a centralized system.

This has been driving the industrial automation architecture specialist with its open and flexible solution for mining and process environments.

"The mine of the future is being designed today," says Nick, who is Managing Director of Beckhoff Automation Australia. "What we're striving to achieve is integration, so that mining and process companies can harness and manage the best of automation technologies and human talent through one open, flexible solution."

This whitepaper explores the possibilities available to the mining and resources sector through advanced automation and predictive maintenance. It discusses how Beckhoff's automation software can integrate different systems and bridge the gap between IT and OT – which is pivotal to the industrial automation landscape. Moreover, it highlights specific control solutions that Beckhoff has developed for mining and process industries, including intrinsically safe I/Os, explosion proof control panels and panel PCs.



The autonomous mine: No longer a remote possibility

Australia has been lauded a world leader in mining automation technologies. There have been numerous examples of the trialling and adoption of automation from drilling, underground cutting to haulage trucks and transportation that are remote controlled by an operations centre. These have been complemented by intelligent software where data analytics informs and affects decision-making[1].

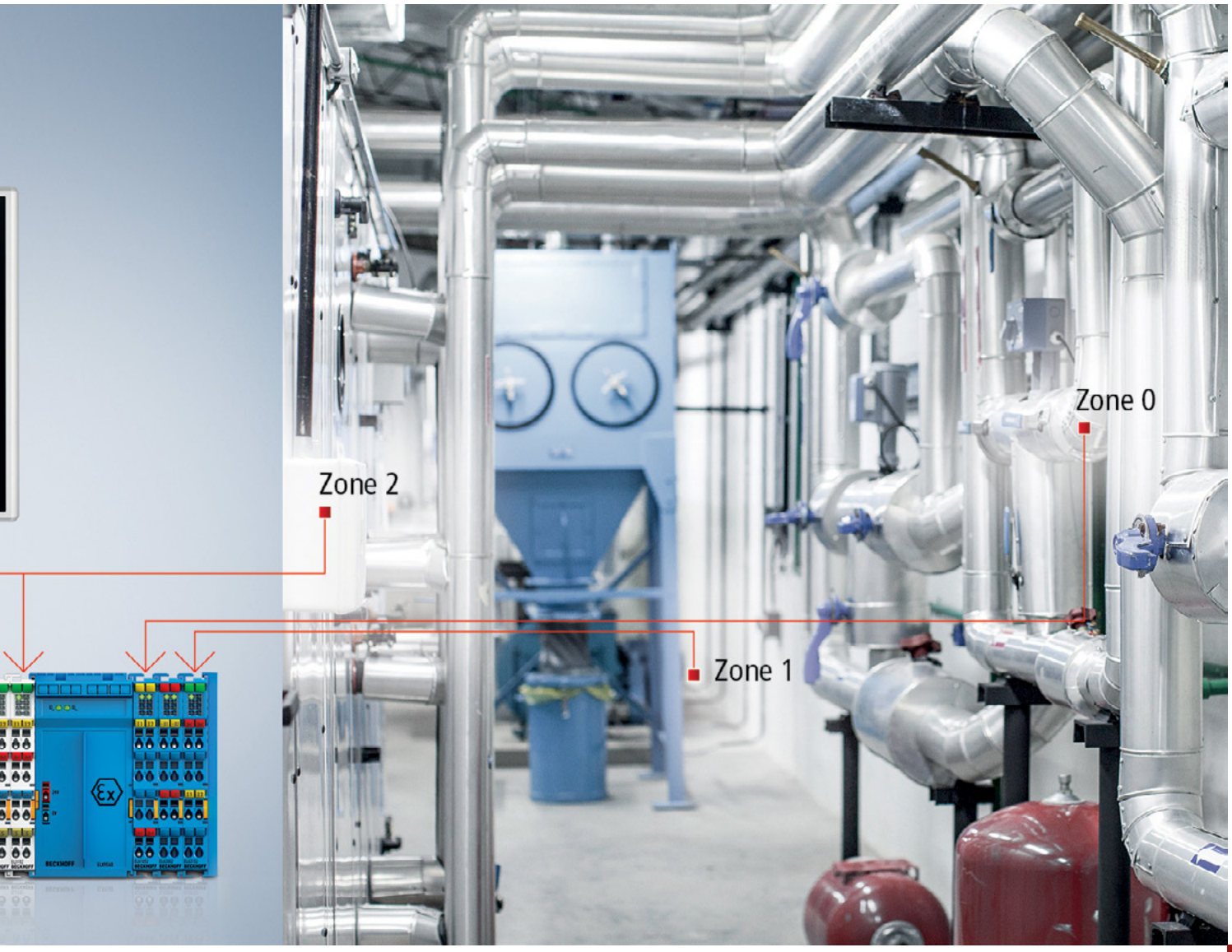
Much of the progress, however, has been disparate. Until now. The pandemic has accelerated the mining sector's embracing of digital capabilities and automation, with a renewed focus on remote ways of working[2].

Nick Psahoulias says this trend is unlikely to change.

"I think COVID-19 has definitely made the industry more aware of what it's capable of. Greater levels of automation and remote operations would allow sites to continue to a larger degree in any new foreseeable world event or disruption to an operation," he explains. "It's fair to say that the pandemic has created a sense of urgency for the innovative technology that supports remote mining."

Having said that, Nick highlights the fact that major miners have been on the journey of automation for many years, with safety as the prime focus. And while safety will remain a core goal, he believes more is expected in terms of efficiency gains, and that mining companies will have access to the best of human talent as they progress further into a remote-controlled future.

"Safety has always been the key objective with automation in mining, as it removes personnel from extremely hazardous situations," he expands. "As technology has evolved over time, these automated processes are now locally controlled by operators using their acquired technical skills. With the introduction of remote mining, backed by fast and reliable internet technologies, these skillsets can now be utilised from anywhere in the country, or globally. In effect, mining companies can harness the best talent, while also accommodating for a family friendly, safe and sustainable work environment."



A central connection

One of the key challenges mine sites face is communication between the automation technologies they have in their employ and in being able to extract information from these technologies into the one, central system.

This is where Beckhoff's PC-based control systems can prove invaluable. The TwinCAT platform works in symphony with advanced automation techniques and provides simultaneous integration of various, dissimilar systems.

"With a sundry of automation vendors on site – each supporting their own communication protocols – it can be difficult, or at least impractical, to get the required information centralised," explains Nick. "Using TwinCAT automation software, we can bring all these protocols together into one centralised location, so that information to be analysed, configured, mapped, or logged."

Additionally, TwinCAT can collate external data including temperature, humidity, weather forecasts, time schedules and more. The system has been designed to have the ability to make automated decisions based on these variables and depending on what it has been assigned to do.

"Global decisions can be made based on this collective data, allowing for a better overall operation of the site," says Nick. "These are high level control systems that bridge the IT and operational technology fields to then bring all the information from a site back into a master controller."

Nick reiterates Beckhoff's history in this area.

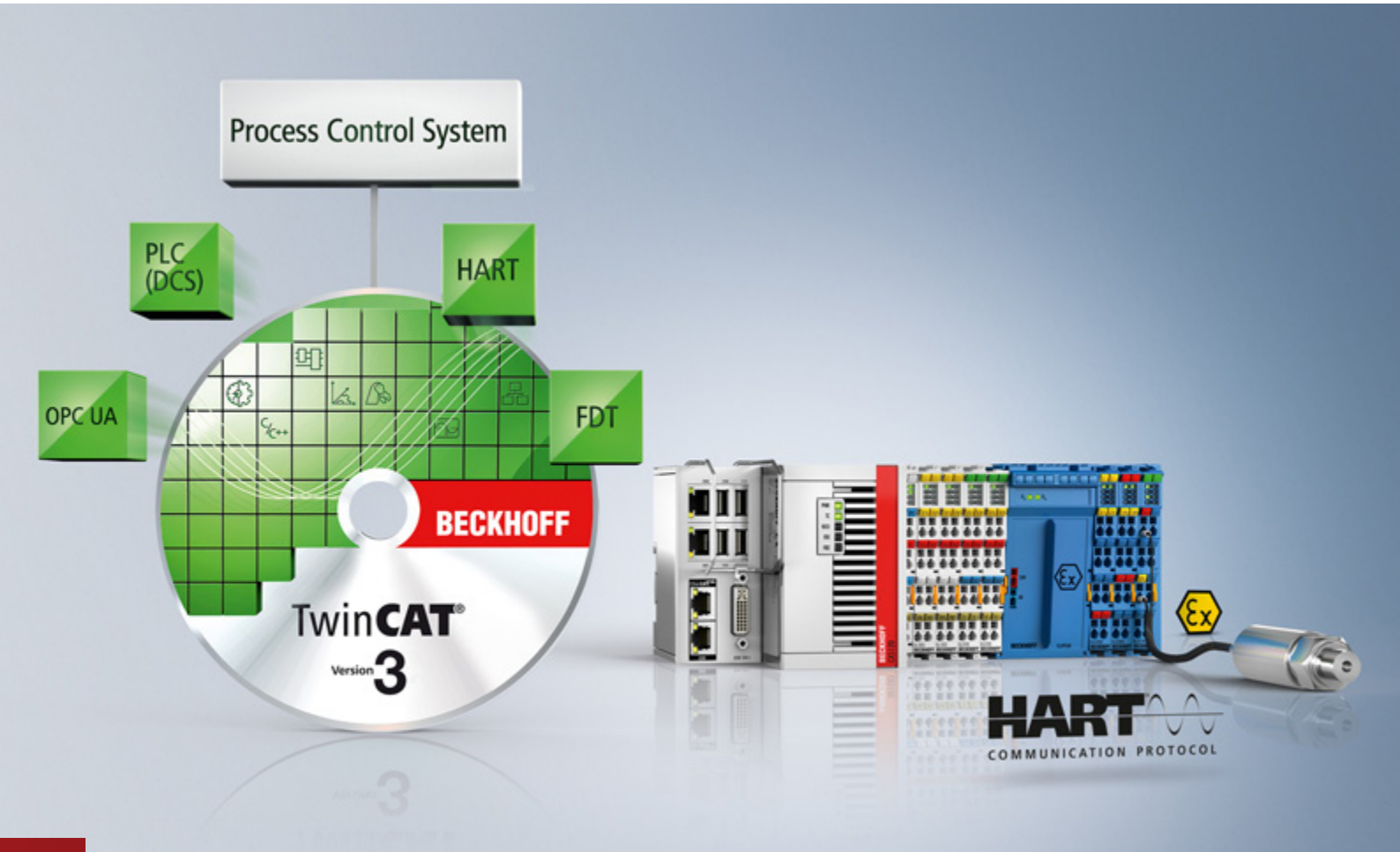
"PC-based automation has been at the core of the Beckhoff control philosophy for over 35 years. It brings together the benefits of powerful multi-core processors, the stability of the IEC programming languages, as well as the flexibility of integrating third-party solutions," he enthuses. "It is truly an open and flexible solution for mining and process environments."

Of course, intelligent predictive maintenance goes hand in hand with the Beckhoff solutions offering.

"The global need to reduce waste and costs, while increasing productivity and reducing the likelihood of failures, has brought about a new suite of analytical tools," Nick elaborates. "Utilising today's industrial automation products, it is now possible to capture, analyse, learn, and make predictions on previous modelling."

The TwinCAT machine learning solution is designed to provide this predictive maintenance functionality.

"This machine learning solution doesn't follow the classic engineering principle of predictive maintenance, which was to design solutions for specific tasks and then turn these into algorithms for the best course of action," Nick expounds. "Instead, the desired algorithms can be learned directly from the model process data, yielding more accurate and reliable results."



Solutions specific to process and mining industries

In recent years, Beckhoff has shown how suitable its open automation and broad portfolio of components is for the mining and process applications. This has included the introduction of intrinsically safe I/Os, explosion proof control panels and panel PCs as well as ANZex certification.

"Beckhoff offers specific control solutions suitable for many automated mining environments," says Nick. "The range includes Zone 0/20 EtherCAT terminals, high-quality control panels and panel PCs, as well as embedded PCs and Bus Couplers for seamless integration with all common fieldbus systems, making the retrofitting of existing systems easier."

Significantly, the ANZEx certified, and highly compact ELX series EtherCAT terminals eliminate the need for separate safety barriers, as these I/O modules can be connected directly to intrinsically safe sensors and actuators that are installed in hazardous areas up to Zone 0.

"The cost and space savings made possible by ELX terminals allow users to build machines and systems that are as compact as they are efficient," Nick explains. "The bottom line: the control cabinet space requirements along with costs and effort involved can be reduced significantly."

Additionally, the Beckhoff CPX panel series is also available in a particularly robust version that makes it highly suited for use in hazardous areas of Zone 2/22.

"The high functionality and high quality of workmanship ensure the durability of the CPX panel even under harsh environmental conditions," Nick says. "Local operation is also comfortable as usual thanks to the capacitive touch technology."

The Modular Type Package

With these specific solutions for the process industry, Beckhoff has actually combined two different automation concepts. Traditionally, their programmable logic controllers (PLCs) were optimised for factory automation, whilst the distributed control systems (DCSs) were designed for process industries. These have converged over the years, driven by technology advances and customer requirements.

This has meant Beckhoff's system architecture has also evolved and is in line with Industry 4.0. The open and modular automation technology allows for easy integration with other systems or existing architecture.

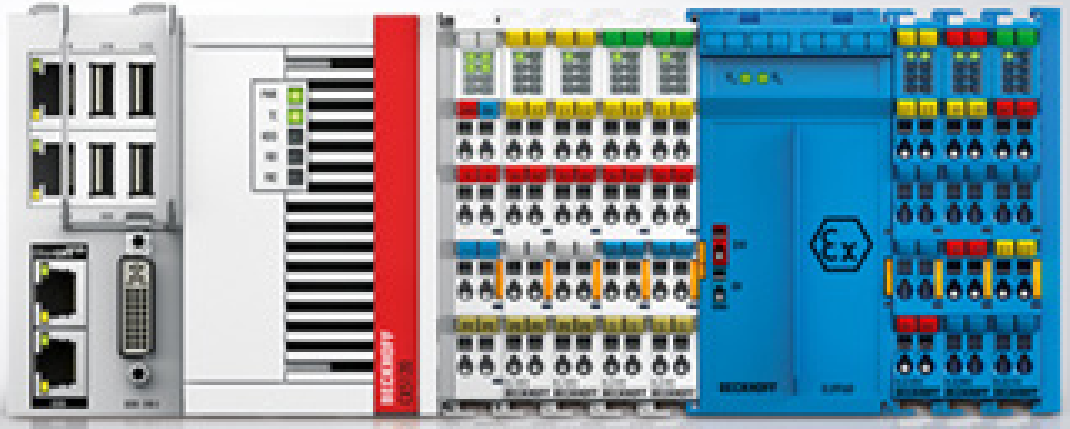
Furthermore, the company have developed a specific solution to meet a current market need – which is for flexibility and individuality in production. The TwinCAT Module Type Package (MTP) enables module engineering for the process industry.

"With TwinCAT MTP, the engineering of MTP-capable modules for process plants integrates directly into the engineering environment of TwinCAT. It offers all options, from the definition of the module and the import/export of an MTP to automatic PLC code generation," explain Beckhoff experts Franziska Dreisewerd and Lennart Winkler. "The goal in developing this new TwinCAT function was to minimise the required guideline expertise and enable the module developer to focus on the actual control logic."[3]

In Summary

To wrap up, Nick says the Beckhoff automation platform is well-matched to the mining and resource industries because it seamlessly integrates process technology into one overarching control system.

"As the mining industry is looking further into Industry 4.0 solutions – which meet safety requirements and optimise productivity – forward-thinking automation technology that can support a range of different communication tasks is becoming essential," he concludes. "The Beckhoff automation platform is ideally suited for these purposes because it integrates a wide variety of standard interfaces. The measurement software and hardware modules allow uniform integration of such applications into the control system, providing the basis for preventive maintenance formed on intelligent machine monitoring. Furthermore, the integration of automation and process technology onto the one platform allows the processing of signals from both hazardous and non-hazardous Zones."



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To learn more about what Beckhoff Automation can do for your business, contact: www.beckhoff.com.au

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