



TwinCAT solutions for IoT and Industrie 4.0

Understanding and improving machines more effectively

The goal of Industrie 4.0 is to optimize production efficiency and to achieve this goal, you have to analyze production data in a target-oriented manner. In line with this approach, Beckhoff introduced a series of specific TwinCAT solutions at Hannover Messe. Ronald Heinze, Editor-in-Chief of ETZ, talked about the latest developments with Hans Beckhoff, Managing Director of the company.

Since Industrie 4.0 will ultimately make manufacturing more efficient, all companies in the field are encouraged to take a close look. It doesn't matter whether it is a "real" revolution or merely the logical advance of technology. "Each revolution has a pre-revolutionary and a post-revolutionary period," points out Hans Beckhoff. "The pre-revolutionary period brings forth a critical mass." Once that has happened, a technological revolution can last for decades.

"Many evolutionary ideas in their totality bring about a new level of quality," continues the Managing Director. "When people look back at this 50 years from now, they will probably realize that the Fourth Industrial Revolution really happened when true machine intelligence began to spread." Whether you see it as a revolution or not, Industrie 4.0 can "bring about a huge advance in productivity for the economy as a whole." The expansion of classic control tasks through applications like big data, pattern recognition, condition monitoring and power monitoring in the cloud leads to a sustained increase in production efficiency.

PC-based control technology as the foundation for Industrie 4.0

Industrie 4.0 has had only a moderate effect on the business models of Beckhoff so far. "However, its impact on our product philosophy has been substantial," says Hans Beckhoff. The company's product portfolio already includes ready-to-use products for IoT and Industrie 4.0 functionalities that help users build the corresponding software infrastructure.

The Managing Director is convinced that there will be no "overall concept" for everyday Industrie 4.0 operations, but that many individual developments by technology leaders will create practical applications that ultimately become market standards. He considers the standardization efforts around RAMI 4.0

and the administrative shell a good and reasonable approach. "Therefore, we support and monitor these developments with great attention," says Beckhoff and continues that it is not imperative that current reference architectures like RAMI 4.0 ultimately become the global standard. He believes that both paths will lead to the goal of arriving at standards through standardization committees and ground-breaking developments by technology leaders. Without a doubt, there will be a series of standards that the corresponding devices and components must be able to comply with. Beckhoff also believes that regional thinking is outdated: "Today's companies find themselves in a global market that is defined through the best ideas and technologies."

As a powerful machine control platform, PC-based automation provides a solid technological foundation for Industrie 4.0 architectures. "PC-based control comes with built-in networking capabilities for horizontal communication and integration with higher-level systems, which makes it the ideal platform for Industrie 4.0 applications," says Beckhoff. "At the base of PC-based automation technology you have central as well as local controllers with Microsoft operating systems and I/O systems with EtherCAT as a fast communication system. It supports all relevant communication protocols and brings together the worlds of IT, Internet and automation technology. There are many industry-specific communication 'languages' that our PC-based control technology understands, and we are confident that the world will become even more diverse as various Industrie 4.0 and IoT variants begin to spread. We and our customers are well prepared for this increase in diversity coming about for competitive reasons and as a result of new applications. We believe that our experience in industrial control configurations will be very useful in our development of powerful and practice-oriented IoT structures for automation applications," says Beckhoff. The convergence of automation technology and IT (AT + IT) is an ideal breeding

ground for IoT and Industrie 4.0 projects. "PC-based control technology is also the best platform for cloud communication," Beckhoff adds, "because this type of communication is part of the PC technology's 'natural habitat'."

Big data in the cloud

Manufacturing companies are increasingly discovering the benefits of big data. Analyzing huge amounts of data makes it possible to accurately predict potential machine failures, to name just one example. The machine controller provides an important source of this data, because this is where all the machine's functions converge. Big data delivers many findings regarding production processes and machine operations, and with regard to downstream equipment," says the physicist. "Analyzing this data in a target-oriented manner quickly delivers valuable benefits." According to Beckhoff, this has been recognized by companies like Google that provide such services and will translate their experiences and technologies from other application areas to the industrial manufacturing world. "The manufacturing segment is too important within the entire value chain to be ignored by the global players in the digital world." Microsoft Analytics or Microsoft Cloud services can already be used by anyone. The Managing Director sees this as an opportunity, not as a threat: "The company that offers the best algorithms for the respective application will have a competitive advantage."

All applications with Beckhoff PC Control technology are essentially ready for Industrie 4.0 today. In addition, the new specific IoT and Industrie 4.0 products from Beckhoff make using these features even easier. The complete process mappings generated by the control technology make it easy for the user to assess the various machines and systems. "Extensive Industrie 4.0 features are available at the push of a button," says Beckhoff. A series of new products makes this possible.

In combination with an Industrial PC or Embedded PC used as IoT controller, TwinCAT IoT software provides a seamless link between the Internet of Things and the Internet of Services. "As an integral part of the TwinCAT automation environment, TwinCAT IoT enables all Beckhoff controllers to communicate with the cloud easily, securely and directly," explains Hans Beckhoff. "Microsoft Azure™ and Amazon AWS™ are among the supported cloud solutions. We are also working on a link to SAP Hana." TwinCAT IoT includes standardized cloud communication protocols such as AMQP for the Microsoft world and MQTT for the Amazon world," he continues. "TwinCAT makes configuring the gateway functionality very easy."

Cycle-synchronous data analysis

At the center of the new Industrie 4.0 solutions is TwinCAT Analytics, which stores the process data synchronously with each cycle for future analysis. The solution provides "very easy and informative machine analyses," says Beckhoff. Examples include online and offline status analyses, predictive maintenance, pattern detection and machine learning, machine optimization and the long-term archiving of data.

The product, which was introduced at the 2015 SPS IPC Drives show, is currently being tested by customers. "The first proposals have been written and some parts of it, such as condition monitoring are already being used," Beckhoff

continues. TwinCAT Analytics features new algorithms and comes with its own database. "Since TwinCAT Analytics is based on TwinCAT 3, users can perform their machine diagnostics with known and proven tools. For example, they can use TwinCAT Scope to graphically display signal flows."

Similar to TwinCAT, users can write their own analytical routines in IEC 61131-3 languages, C++ or MATLAB®/Simulink®. It's up to the users and their needs. "They can even mix and match," says Beckhoff. "Accordingly, they have an easy-to-use tool at their disposal, and in combination with MATLAB®/Simulink®, a very powerful one." The TwinCAT Analytics Workbench can be used for this purpose. Users can run online or offline analyses for one or multiple machines with help from modules in the TwinCAT Analytics library. The Workbench contains the Analytics library, a PLC library with modules for functions like cycle analysis, lifecycle monitoring, condition monitoring, as well as power requirement and RMS calculations. Experienced PLC programmers can also use the library modules in their own PLC applications to integrate monitoring functions into the machine control system.

Access to the entire process image

To be able to analyze data, you must first record it. That's why Beckhoff has introduced the TwinCAT Analytics Logger for the cyclical backup of large data volumes. "The Analytics Logger records all process data," explains Beckhoff.

"Analyzing this data in a target-oriented manner quickly delivers valuable benefits."

"You can then use TwinCAT Analytics to perform online or offline analyses based on the process image." A classic application example is condition monitoring, i.e. the monitoring of components' lifecycles. The software can count signals or operating cycles and indicate predictive replacement intervals. It can also assign temperature flows to specific machine conditions or determine the power consumption of individual machine components. This lets the user see where the machine consumes energy without increasing the workload of the controller. Time optimization is another potential application. "It determines the timing of individual processes, measures timestamps and assigns limits," says Beckhoff. "The system recognizes any process time violations." Recording all machine data with the TwinCAT Analytics Logger is particularly useful for service technicians. It enables them to identify errors that occur while the machine operator is absent. "All of these features are highly process-relevant, because they provide a better understanding of the machine," says Beckhoff.

TwinCAT Analytics also works with the popular TwinCAT 2 software version. "For this version we have with our 'Data Agent', another tool for reading data from these controllers and forwarding them via the IoT protocol," explains Beckhoff. "A user who wants to analyze an existing system can simply install our TwinCAT Data Agent. The actual machine control program does not need to be changed." The data for TwinCAT Analytics can be stored locally in the machine controller, on the local server or in the cloud.

The data formats have been designed for easy access and further processing via analytics services like those available from Microsoft and Amazon. "This makes it easier to get involved in Industrie 4.0 and create powerful applications," says Beckhoff. TwinCAT Analytics uses the same communication protocols as Microsoft Analytics. Users can also receive application-specific support from Beckhoff.

Beckhoff already offers a broad portfolio of IoT and Industrie 4.0 applications and believes that demand will increase rapidly. "We will present exciting new products in this field at Hannover Messe 2016," Hans Beckhoff concludes contentedly.

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Further information:

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