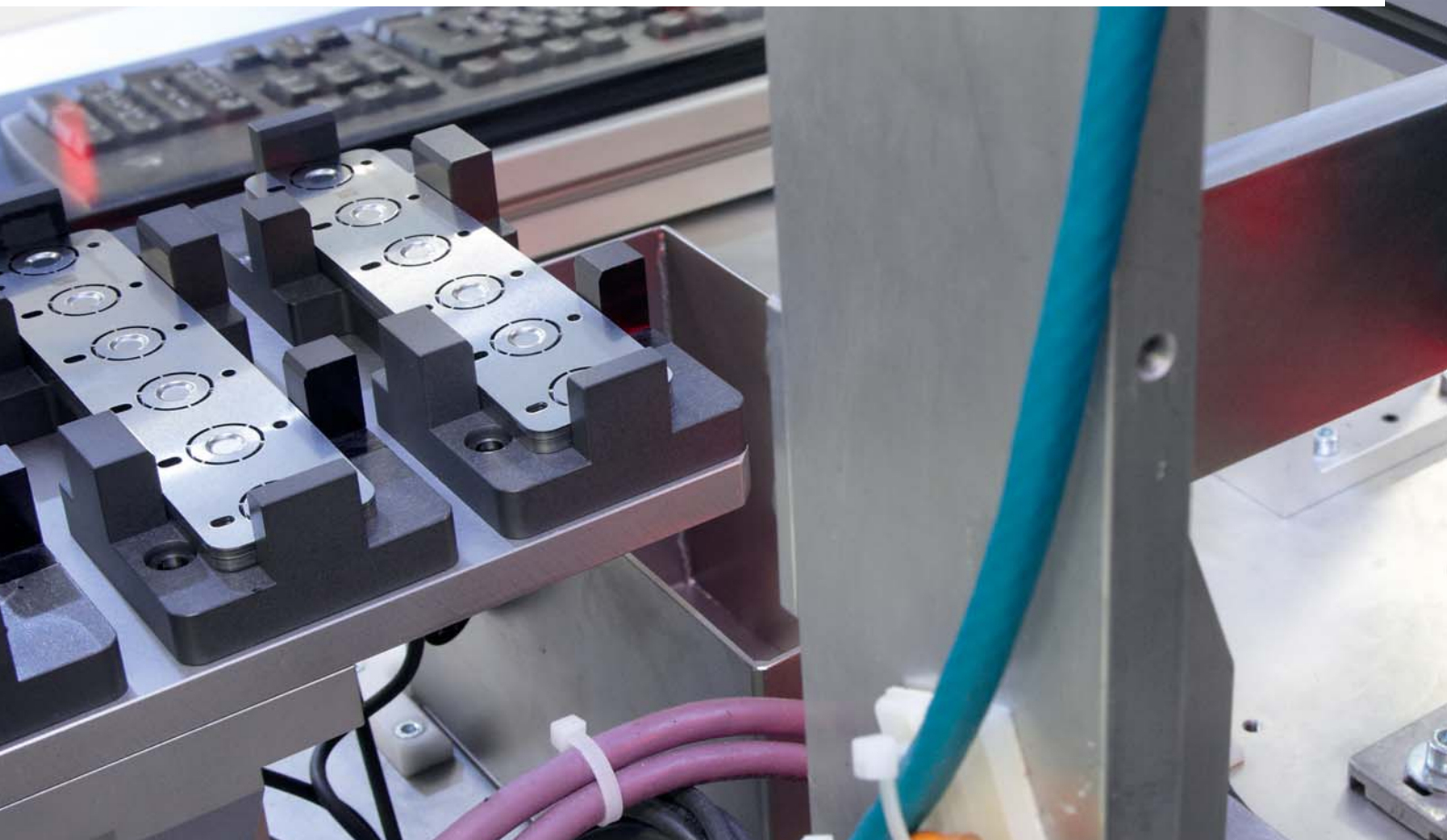PC-based Control replaces control-related "overgrowth"

Open control technology: TwinCAT links existing machine control with SAP system

Small, lightweight, quiet and fast: the eFlow® nebuliser developed by PARI Pharma has been used for treating cystic fibrosis patients for many years. The aerosol generator of this sophisticated inhaler, the so-called "head," is produced by PARI Pharma in Gräfelfing, Germany. The company is currently in the process of converting its control systems to Beckhoff control technology, with the goal of optimizing the automation of its production equipment. Via an MPI library for TwinCAT developed by esqmate, the existing S7-PLC can be linked with the Beckhoff control platform without the need for proprietary hardware, thereby enabling direct communication with the SAP system from PARI Pharma.

The CX5020 Embedded PC from Beckhoff communicates directly with the S7 control-ler via the EL6731 PROFIBUS DP master terminal and the MPI software library. Only a PROFIBUS cable is required here, additional hardware is not necessary.

PARI Pharma has maintained its reputation as a world-renowned specialist in respiratory therapy for over 100 years. Today the global company develops and produces advanced systems for inhalation therapy. The aerosol generator of the eFlow® system passes through no less than 12 production and testing stations. All manufacturing steps, including "flattening" and laser treatment of the membrane and packaging are quick, reliable and smooth.

PC-based Control replaces control-related "overgrowth"
PARI Pharma started converting its systems to advanced, PC-based control from Beckhoff in 2011. "Before the changeover our technical infrastructure was somewhat inefficient," said Ronald Schmidt, Project Manager at PARI Pharma. A heterogeneous and very complex mix of control programs for the S7 PLC as well as PC programs in C++ and LabView made maintenance without special-ized programming knowledge nearly impossible. In the event of a fault we therefore had to call in external specialists on a regular basis. Moreover, the old system was error-prone since it was not possible to integrate the system control with a database. The PC data determined from the PLC had to be entered manu-ally in the databases for further processing.

During this production step the 2D bar code of the membrane pad is read and subse-quently processed by the CX5020. Tracking is only made possible by this identification step, which is coupled with direct access to the Oracle database. In this way each membrane in any machine can be unambiguously identified and the status deter-mined. Only membranes with valid part status, which have passed error-free through all previous production steps, are processed further.

From left to right: Raphik Shahmirian, distribution, Beckhoff Munich branch,
Ronald Schmidt, project manager of PARI Pharma, and Markus Kräutner, managing
director of esqmate.

Intelligent integration via standard interfaces

Unambiguous, traceable parts management is a prerequisite for a complex production process, in which two separate machining operations are executed in one manufacturing cell. After the first production step the part is initially removed, processed further and subsequently returned to the machine for a further machining operation. To this end the parts must be scanned and identified before each production step. "For years we had been looking for a machine control system that is able to communicate directly with the databases," said Ronald Schmidt. In the end we chose the TwinCAT Database Server in conjunction with the EL6731 PROFIBUS master terminal for the EtherCAT Terminal system from Beckhoff. "However, we didn't want to and couldn't replace the old S7-PLC immediately during continuous operation. We were looking for an option to control it via the Beckhoff system without the need for proprietary hardware," said Ronald Schmidt.

Software-based solution without additional hardware

The solution was provided by esqmate GmbH, based in Unterföhring near Munich. The company developed an MPI library for TwinCAT, which ensures that the Beckhoff controller can communicate directly with the old PLC via the

MPI library for TwinCAT

The MPI library from esqmate for the first time enables interfacing of existing S7 solutions with a Beckhoff controller via an MPI interface without additional gateways. This means that proprietary PLC database solutions can be replaced with open Beckhoff hardware in conjunction with standard software products. A further benefit is the security offered by the solution: the software library communicates directly via the EtherCAT network of the machine and is therefore protected against virus attacks or other threats that could be transmitted through the corporate network.

PROFIBUS master terminal and the MPI protocol. No additional hardware, such as MPI/Ethernet gateways, is required. The need for PCI slots in the PC is also avoided by connecting the EL6731 PROFIBUS master terminal via EtherCAT. In this way it is possible for the first time to access S7 data blocks and flags directly from TwinCAT via an EtherCAT Terminal. No modifications of the existing S7 controller were required. Data exchange takes place in TwinCAT via function blocks. "Based on the EL6731 PROFIBUS master terminal we were able to successfully implement a PROFIBUS/MPI stack for microcontrollers, which we had developed earlier in the TwinCAT library," said esqmate managing director Markus Kräutner.

Standardization of the control architecture through PC-based control

A CX5020 Embedded PC from Beckhoff reads data from the S7 controller via the EtherCAT Terminal, links them with the new bar code system and sends them directly to an Oracle database or PARI Pharma's SAP system via the TwinCAT Database Server. In addition to reading and writing data, the TwinCAT Database Server also enables calling of "stored procedures". In these PARI Pharma stores command and instruction sequences for processing in the database. The procedure results are sent to the database server and are then available in the PLC again. The PLC code is simplified significantly through the option of executing procedures in the database.

PARI Pharma's intention was to retrofit all systems to utilize new Beckhoff control technology by the end of 2012: "We want to become faster and more flexible by standardizing and simplifying our control concept," said Ronald Schmidt.

A Beckhoff CP7902 Control Panel is used as the HMI. The interface was developed based on customer specifications and enables the operator to follow each process step exactly. Based on the scanned bar code the current production step is validated from the Oracle database, and the next required program is automatically started in the S7-PLC via the EL6731. System operators can log in conveniently and securely via an integrated RFID token.

The complex production of the aerosol generator of the eFlow® inhalation device takes place in no less than 12 production and test facilities. For seamless tracing of the parts during the different machining operations the parts must be scanned and unambiguously identified before each production step. This is realized via a system based on an Oracle database and the Beckhoff control platform.

Central SAP evaluation for more efficient production

"Because direct communication is now possible between the existing S7-PLC, the new Beckhoff controller, the Oracle database and our SAP system, we are at last able to link the control world with business management solutions," said Ronald Schmidt, commenting on the progress achieved. At PARI Pharma analyses now no longer take place in the plant itself, but centrally in the SAP system. The SAP system receives test data from the Oracle databases connected to the Beckhoff systems and generates item lists, work schedules and approval reports or manages the inventory based on these data. This enables staff to focus on their core competence: production. Quality control has also become simpler and more reliable. Staff members no longer have to acknowledge manually because approvals are automatic via bar codes. Thanks to the new control technology PARI Pharma is now also able to use parallel, rather than order-specific production. This comes in handy considering increasing production quantities. "We are now able to produce individual components in parallel and no longer have to move whole assemblies from line to line," said Ronald Schmidt. "Since each part is furnished with a serial number, we have optimum control and can always deliver exactly what is required."

Cost reduction through standardized control concept

PARI Pharma now has full control of its production thanks to cutting-edge, PC-based control technologies. Smooth communication between the machine controllers and the business management systems not only ensures error-free and faster processes on the plant floor, but also results in cost reductions: "Because everything remains in-house and we are able to keep maintenance and programming efforts to a minimum, we save time and costs. In turn, we can reinvest these savings in new machines," Ronald Schmidt concluded.

Further Information:
www.pari.com
www.esqmate.de

PARI Pharma GmbH

PARI has maintained its reputation as a world-renowned specialist in respiratory therapy for over 100 years. Today PARI Pharma GmbH, with headquarters in Starnberg and part of the PARI group of companies, develops advanced devices for inhalation therapy. Marketing and distribution for Germany, Europe and the rest of the world are also based here. The eFlow® nebuliser developed by PARI Pharma is electronically controlled and generates homogeneous aerosols for the treatment of pulmonary diseases through a vibrating stainless steel membrane with several thousand holes.

esqmate GmbH

Whenever automation technology and embedded systems are called for, esqmate GmbH is positioned as a solution provider and development partner especially where conventional solutions reach their limits. "We cover the fields of automation technology, bus systems and embedded systems. This enables us to develop tailored, integrated solutions that minimize possible errors," said esqmate's Managing Director Markus Kräutner. In order to achieve practice-oriented results, the company develops its IT solutions from production to IT – not the other way round. Special attention is paid to an intelligent and efficient mix of standard and custom solutions.