



Rotary dial and index machine with 12 positions for complex processes with short cycle times. Two robots from ABB deal with inserting the blanks and removing the finished shafts.

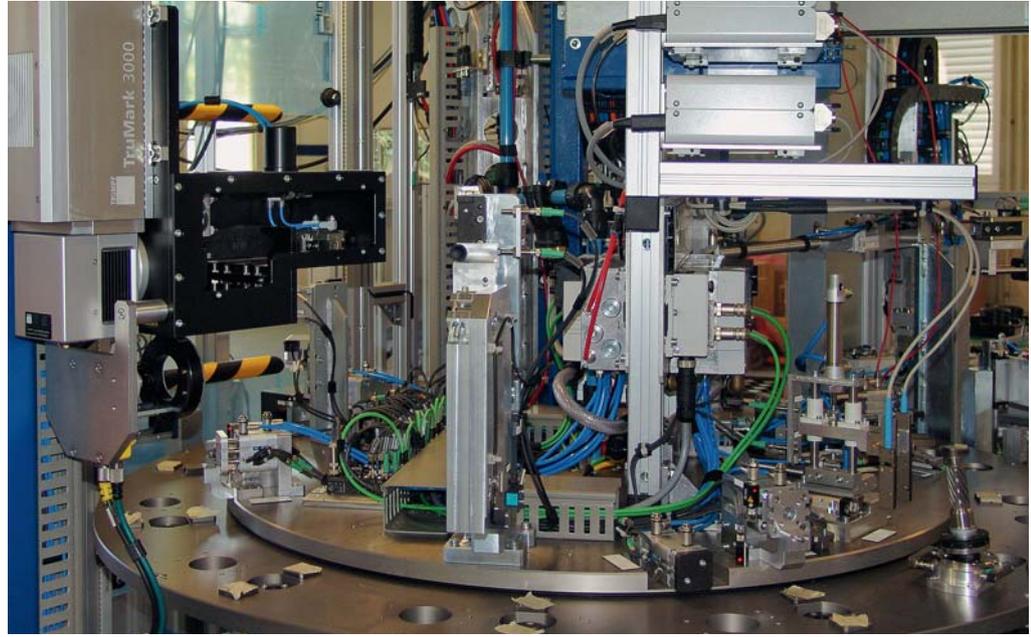
Virtually no limits for machine design enhancements

Maximum flexibility: PC control platform enables vertical and horizontal integration

The Swiss company LCA Automation has almost 40 years of experience in the design and construction of complex production and assembly systems for a wide range of components and end products. Many of LCA's customers come from the automotive sector. The production of safety-relevant vehicle parts places stringent demands on the reliability of the assembly systems: from precise, high pressure pressing to dynamic component handling. In order to offer maximum precision, flexibility, dynamics and worldwide availability, LCA uses the integrated PC- and EtherCAT-based control platform from Beckhoff.



The hydraulic high-performance press (8 t), one of LCA's standard products, is controlled with TwinCAT.



For a special machine manufacturer such as LCA Automation the flexibility of the Beckhoff control platform is a key factor, because a wide range of third-party systems must be integrated into the process machines, e.g. a laser labeler from Trumpf Laser, which is used to apply the 2D data matrix code, or a camera system that checks whether the code was applied correctly.

In the early 90s LCA, based at Affoltern near Zurich, Switzerland developed the first automatic camshaft facility for the automotive industry. It was an interlinked system that could handle complex processes. With its machine concept, today the company has established itself as a supplier for the automotive sector worldwide. This is all the more impressive because of the fact that there are no car manufacturers in Switzerland.

Being prepared for change

LCA sees its success based on the high flexibility with which the company responds to customer requirements. "This enables us to offer solutions that differentiate us from the big players in the market," said Dr. Christoph Rennhard, Managing Proprietor of LCA. "In many cases customers request changes almost right up to delivery. For us it is a matter of course that improvements or modifications are continuously incorporated during the realization of our systems. One of our strengths is that we can implement such changes rapidly." Nearly all the systems that LCA builds and delivers are modified or expanded over the next five, six or ten years. "This kind of thinking is in our heads and factored into the machine concept right from the start," said the company owner.

Competence in control technology

LCA creates complete solutions, including design, assembly, commissioning and system acceptance by the customer. The first step is the concept development. Once an order has been placed, the machine is constructed using cutting-edge CAD systems. "The mechanical production of machine parts and components is the only task we currently subcontract," said Ueli Imhof, a member of LCA's management

with responsibility for assembly, administration and purchasing. "Assembly, electrical engineering and control cabinet construction are all done in-house. This also includes the design of the control system and the required sensors, among other things."

"LCA developed its own PLC controller 20 years ago," said Rainer Pözl, Director for control engineering at LCA Automation. "This controller could handle four process axes simultaneously and independently. It was our competence in control engineering that enabled us to establish ourselves in the automotive sector." The primary reason for the change-over to PC-based control technology from Beckhoff was customer demand for worldwide availability of service and support.

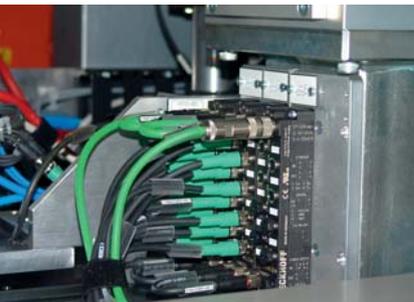
"Initially we used PROFIBUS for communication purposes. When EtherCAT became available we switched to the fast Ethernet fieldbus, although PROFIBUS is still used in parallel, because of the fact that there are still some devices that can only be controlled via PROFIBUS," said Rainer Pözl. "The fieldbus devices can be integrated easily in the Beckhoff EtherCAT Terminal system via flexible interface terminals."

Horizontal integration

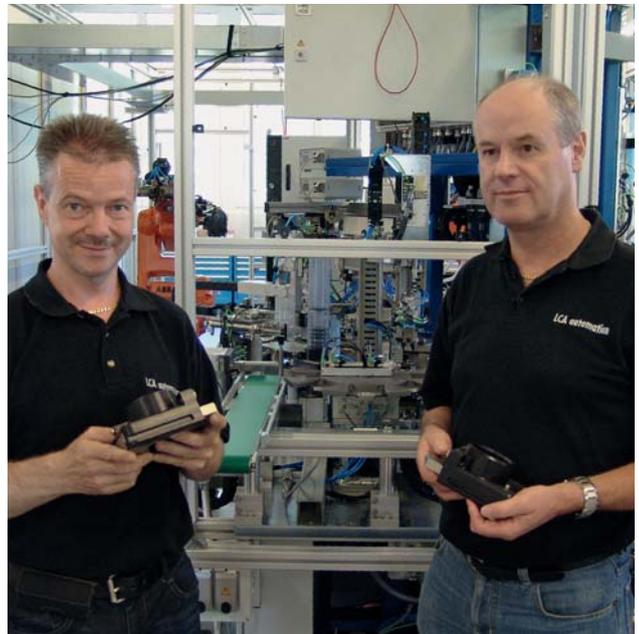
LCA has long-standing experience in the automation of a wide range of processes. "The scalable automation system from Beckhoff ideally matches our diverse range of requirements," said Rainer Pözl. LCA uses the CX1020 and CX1030 Embedded PCs and the C6240 Industrial PC (IPC) with Beckhoff Control Panel as the HMI or, in smaller systems, a Panel PC. Beckhoff I/O systems are used for the connection to the field level, that is Bus Terminals, EtherCAT Terminals and EtherCAT Box modules in IP 67 design installed directly on the machine.



Control cabinet for controlling at rotary dial and index machine with 12 positions. One C6240 Industrial PC is used for data acquisition and communication with the higher-level EDP system. A second C6240 deals with calculating the complex algorithms on the systems. Two CX1030 Embedded PCs with EtherCAT Terminals act as machine controllers.



LCA uses EtherCAT Box modules in IP 67 protection, which also met the customer requirement for very compact design.



Ueli Imhof, Management, assembly, administration, purchasing, and Rainer Pözl, Director of Control Engineering at LCA Automation (left to right)

The Beckhoff product portfolio also covers the software requirements of the special machine manufacturer. "TwinCAT PLC is used for standard run-time tasks. For positioning tasks we use Level NC PTP," said Rainer Pözl.

The flexibility of the Beckhoff control platform plays a key role for LCA, because a wide range of third-party systems have to be integrated into the process machines, including sorters, riveting units, screw systems, pressing and joining systems, printers, laser labelers, welding systems, forming systems, identification and image processing systems, to name but a few. For horizontal integration, LCA has access to a wide range of bus interfaces.

Standardized interfacing with MES and ERP systems

Interlinked assembly systems require not only internal, horizontal integration of complicated sub-processes, but also integration of handling or material transport systems. In addition, interfaces to higher-level MES or ERP systems have to be realized. "In this regard custom software is the key factor," said Rainer Pözl and added: "We use OPC for transferring process data to the customers' EDP system. We realize the required coupling depending on the interface required by the customer."

In assembly systems for safety-related products such as vehicle steering columns, the individual manufacturing steps must be checked and documented, because traceability must be ensured in the event of a component failure, so that any liability issues can be resolved. This means that a great many sub-processes must be monitored using suitable sensors and the measured data must be analyzed, stored and transferred to the manufacturer's documentation system. "Beckhoff technology is ideally suited for this task: On one hand, special Bus

Terminals can be used to integrate the sensors directly in the machine environment and on the other hand data acquisition and analysis are among the standard tasks performed by PCs, and, last but not least, the data transfer to the documentation computer is straightforward.

A small "to-do list"

The collaboration between LCA and Beckhoff Switzerland is characterized by a co-operative approach. "At the top of our current automation wish list is TwinCAT 3," said Rainer Pözl. "We have great hopes for the new version. We intend to transfer certain functions of our existing hardware PLC, which we developed in-house, to software and integrate it into TwinCAT 3."

Another, perhaps easier to realize target is already on the agenda: the safety technology of the systems. Currently LCA still uses traditional safety switching devices and solutions. "However, the requirement for safety calculations to be based on the new Machinery Directives from 2012 makes the software-based safety PLC and TwinCAT 3 from Beckhoff more than welcome," said control expert Rainer Pözl.

Ueli Imhof added: "We take a very pragmatic approach when it comes to weighing up the safety of our machines and systems. For example, we work with hydraulic systems involving large forces and therefore must consider a high risk potential. The second point that is important to us is customer relations. Our safety technology has to be flexible because customers have a tendency to ask for last-minute modifications on the machine, in some cases right up to one week before delivery. The Beckhoff safety solution helps us solve these scenarios."

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