Ultra-compact Industrial PCs: a new device generation for advanced machine concepts

 AMP8000: Distributed Servo Drive system for modular machines

 IMA Klessmann and Fournier: TwinSAFE SC I/O terminals and analog sensors monitor transport of workpieces
news

4 | Trade show preview 2018

6 | Fertig Motors inaugurates new mechanics production facility

products

8 | Ultra-compact IPCs: new device generation for automation, visualization and communication

12 | Interview with Roland van Mark: Consistent expansion of the ultra-compact IPC family

14 | AMP8000 – Distributed Servo Drive system for modular machine concepts

18 | Interview with Andreas Golf: AMP8000, the ideal drive system for modular machines

20 | Highly compact electronic overcurrent protection in 12 mm EtherCAT Terminals

worldwide

22 | Fournier SA, France: Simple, flexible and cost-effective machine safety implementation

28 | Dentsply Sirona, Switzerland: Machine evolution yields higher efficiency and quality in processing

32 | Mühlbauer, Germany: Customer-specific I/O level promotes highly efficient machine construction

36 | Beckhoff India celebrates 10th anniversary

38 | Hudson Scenic Studio, USA: Blockbuster effects, automated for any theatrical production

42 | Nedschroef Machinery, Belgium: Highly dynamic servo drive technology optimizes forming machine used for fasteners

44 | Valka, Iceland: Robot-assisted filleting machinery revolutionizes fish industry

46 | Smart Factory, Italy: Assembly solution 4.0 for more efficiency in lot size 1 production

48 | Suruga Seiki, Japan: Industrie 4.0 finds its way into production of precision positioners

ETG

50 | News and activities of the EtherCAT Technology Group

events

52 | Trade shows and events 2018
The new IPC generation from Beckhoff: “an immaculate member of a flock of sheep”

In your professional life, I’m sure you are familiar with the elated feeling you get when your new machine is successfully put into operation for the first time. Or when your team has presented a new, state-of-the-art HMI and the customers are delighted. Or your newly programmed 5-axis CNC works faster and with greater precision than ever before. – After all, it is this high level of identification with the project that drives us forward time and again when we keep looking for new and better solutions that enable us to tap into optimization potential – even if only in the details. And when we do, we are justifiably proud and enthusiastic about our achievements!

My colleagues say that I have a certain tendency towards such feelings of euphoria and that I am able to present any topic with infectious enthusiasm. And indeed, I can get very passionate about new things. Nevertheless, in order to spark this enthusiasm, I do need an appropriate occasion, in other words, a really well accomplished product or project. The new generation of ultra-compact Industrial PCs, which I would like to introduce to you today, is exactly the kind of occasion that gets me going. In developing this series of equipment, we focused on the truly essential, so to speak the existential, things that a PC should be able to do. The result is control systems that are smaller, more powerful, more flexible and affordable than anything on the market to date; and I think we are rightly so proud of this.

As Albert Einstein once said: “In order to be an immaculate member of a flock of sheep, one must, first and foremost, be a sheep.” Einstein most certainly did not have an Industrial PC in mind, when he created this metaphor for similarities being a prerequisite for parts of a whole. Nevertheless, I would like to use this analogy to take a closer look at the idea that is behind the continuous expansion of the Beckhoff family of Industrial PCs: In order to meet all our customer requirements, we are working continuously on the scalability of our control solutions so that they exactly meet your application requirements in terms of design, performance and price level. The new C6015 and C6030 series of ultra-compact Industrial PCs, which we are presenting in this issue starting on page 8, fit seamlessly into the Beckhoff IPC portfolio and – to stay in the picture – have been added to the flock of sheep as “immaculate members”.

I would like to present these two milestones of Industrial PC development to you personally to give you an impression of how much teamwork, know-how and detailed problem solving are involved when high-end computing power is put into an ultra-compact design. After all, the simpler a solution might appear, the more sophisticated and sustainable it probably is. I’m sure you’ll share my enthusiasm.

As usual, the current issue of our PC Control magazine offers you a wide range of solutions and application reports from the field, all designed to help you succeed in your next automation projects.

Keeping this in mind, I sincerely hope you enjoy your reading!

Roland van Mark,
Product & Marketing Management
Industrial PC
**Automotive Testing Expo**

Beckhoff will present its high-end measurement technology at the Automotive Testing Expo 2018. The EtherCAT measurement technology modules open up possibilities in automotive test environments in terms of accuracy, value and time precision, synchronization and long-term measurement accuracy that were previously only possible with expensive special equipment. Using TwinCAT software, measurement data can also be processed and analyzed in a public or private cloud.

**Stuttgart | 05 – 07 June 2018**  
Hall 8 | Booth 606  
[www.beckhoff.com/automotive-testing-expo](http://www.beckhoff.com/automotive-testing-expo)

---

**Automatica**

The lead theme for Automatica 2018 is "Optimize your Production", which will be highlighted and consistently showcased at the Beckhoff booth. Examples will include the additional integration of image processing, high-precision measurement technology or cloud services into the central control system. Optimization potential is also offered by One Cable Automation based on EtherCAT P, which reduces material and assembly costs.

**Munich | 19 – 22 June 2018**  
Hall B6 | Booth 320  
[www.beckhoff.com/automatica](http://www.beckhoff.com/automatica)

---

**Achema**

At Achema 2018, Beckhoff will be demonstrating the use of PC-based control technology for the process industry: from components for explosion protection and control solutions for general process engineering applications to large-scale plants in the oil and gas or petrochemical industries. The focus is on continuous communication from the sensor in Zone 0 right through to the cloud.

**Frankfurt am Main | 11 – 15 June 2018**  
Hall 11.0 | Booth E43  
[www.beckhoff.com/achema](http://www.beckhoff.com/achema)
With 80,923 visitors and 1,296 exhibitors, the ISE trade show for AV system integration achieved the best results of its 15-year history. “ISE is the ideal platform for Beckhoff to convince system integrators of the advantages of our integrated control solution. This technology makes it possible to connect and run all systems and applications of media technology, building control and IoT on one CPU,” explains Michel Matuschke, Vertical Market Manager Stage and Show Technology.

More information and Trade Show TV: www.beckhoff.com/ise

Integrated Systems Europe (ISE)
Media and building systems control on one platform

With 80,923 visitors and 1,296 exhibitors, the ISE trade show for AV system integration achieved the best results of its 15-year history. “ISE is the ideal platform for Beckhoff to convince system integrators of the advantages of our integrated control solution. This technology makes it possible to connect and run all systems and applications of media technology, building control and IoT on one CPU,” explains Michel Matuschke, Vertical Market Manager Stage and Show Technology.

More information and Trade Show TV: www.beckhoff.com/ise

Sensor + Test

The focus at Sensor + Test 2018 is on PC- and EtherCAT-based measurement technology products. Beckhoff offers an end-to-end measurement chain: from the electrical connection of all common sensors to I/O modules in various protection degrees via the EtherCAT measurement technology fieldbus to various “on-premises” TwinCAT software modules. Cloud connectivity is also provided by the overall control system.

Nuremberg | 26 – 28 June 2018
Hall 1 | Booth 350

www.beckhoff.com/sensor-test

Anuga FoodTec 2018

Optimised food production and resource efficiency

Resource efficiency was one of the key topics at Anuga FoodTec 2018. Beckhoff demonstrated how to implement efficient resource management with XTS Hygienic, which combines the advantages of rotary and linear systems in a stainless steel version for demanding environmental conditions. The linear transport system enables maximum flexibility, high productivity, and a reduced system footprint all at the same time. With high resistance to chemicals and high-pressure cleaning, the system is designed for the needs of the food industry.

More information: www.beckhoff.com/anugafodtec

Tire Technology Expo

Reduced space requirements, increased energy efficiency

The Beckhoff trade show presentation at Tire Technology 2018 focused on: efficient production and cost reduction with an integrated, ultra-compact control platform. “With such products as EtherCAT P or the distributed Servo Drive system AMP8000, which effectively halve the cabling requirements and reduce the machine footprint through smaller control cabinets, we were able to attract a lot of interest from trade fair visitors,” is how Klaus Büttner, Business Manager for the tire and rubber industry, sums up the results of the trade fair.

More information: www.beckhoff.com/tiretech
What began with a ground-breaking ceremony on 9 March 2017 was occupied in September 2017 after a construction period of just six months and officially inaugurated on 23 February 2018: Fertig Motors’ new mechanics production facility. The company belonging to the Beckhoff Group primarily develops and produces servomotors for Beckhoff at its site in Marktheidenfeld.

Beckhoff drive technology with increased manufacturing depth

Over 4 million euros were invested in the construction of the production facility alone. A production area of 2500 m² has been created plus an additional 1000 m² for offices and common rooms. Apart from that, around 3 million euros have been invested in ultra-modern, high-value CNC machines in addition to the development of the necessary CNC know-how by the staff. Fertig Motors’ Managing Director Dietmar Hamberger explains the motivation behind the project: “The motor shafts and housings for our AM8000 servomotors previously came from suppliers, but now we can manufacture the majority of these ourselves and thus considerably expand the manufacturing depth and our own assembling competence. That is an important step towards securing our high quality standard, even with the enormous growth of the company. Not only that, having our own mechanics production simplifies the fastest possible implementation of individual customer requirements as well as of prototypes and innovation projects. These three manufacturing aspects – supply reliability, flexibility and speed – form the ideal basis for being able to produce more than 100,000 servomotors annually by 2020 at the latest.”
The new, modern mechanics production facility is situated very close to the Fertig Motors head office in Marktheidenfeld.
Ultra-compact Industrial PCs: a new device generation for automation, visualization and communication

A new path appears for modular and IoT-capable machines and systems
As machines and systems are becoming more modular and control cabinets smaller, the space requirements of control components are increasingly scrutinized. At the same time, ever more complex and sophisticated machines require more computing performance. However, there are also more cost pressures in the field of automation. In order to meet all these requirements, Beckhoff has developed a new series of ultra-compact Industrial PCs (IPCs) — starting with the C6015 and the high-end C6030. These devices are ideal for a broad range of applications, including environments with decentralized architectures and today’s Internet of Things (IoT) and Industrie 4.0 applications.

The new series of ultra-compact Industrial PCs premiered with the C6015 at the 2016 SPS IPC Drives trade show in Nuremberg, Germany. Equipped with an Intel® Atom™ CPU, it is well-suited for all kinds of automation, visualization and communication tasks in the medium performance range. Measuring only 82 x 82 x 40 millimeters, the ultra-compact and industrially-suited multi-core IPC is only one-third the size of the C6905, previously the smallest control cabinet IPC in the Beckhoff portfolio. With price savings of approximately 25 percent, the C6015 ranks far below the previously lowest-cost x86 IPCs from Beckhoff. With exceptional installation flexibility, it also opens the door to application areas that were previously unattainable for IPC technology due to cost or space limitations.

The four factors of a true success story
The ultra-compact C6015 IPC was a true success from the very start. It has already been deployed in a wide range of applications in high volumes, including many large-scale projects in Germany and abroad. The concept of the new IPC generation impressed users for several reasons:

- The most important and obvious feature of the C6015 is the extremely compact size that does not compromise suitability for industrial applications. This is underscored by a design with passive cooling and long-term availability in a robust aluminum and zinc die-cast housing. It also meets all other industrial requirements, such as an expanded temperature range from 0 to 55 °C (32 to 131 °F) and exceptional vibration and shock resistance.
- Combining high computing power with low energy consumption, the C6015 leverages Intel® Atom™ CPUs with up to four cores, providing the ideal basis to handle all applications in the low to medium performance range.
- The exceptionally flexible installation concept permits vertical or horizontal back wall installation in control cabinets. Moreover, with its symmetrical cooling fins, the C6015 can be positioned freely within the mounting frame. Features like these and the free orientation of the connector level, with all connectors on a single side, allow a wide range of installation scenarios that

**Features of the C6030:**
- Processors: Intel® Core™ i of the 6th and 7th Generation with up to 3.6 GHz per core in the quad-core version
- Interfaces: 4 Ethernet, 2 DisplayPort, 4 USB 3.0
- Main memory: up to 32 GB DDR4 RAM
- Dimensions (W x H x D): 132 x 132 x 67 mm
accommodate all incoming cable feeds in even the smallest spaces. In the past, this was often impossible, precluding the use of an Industrial PC in certain machine designs.

– The features and interfaces of the C6015 are also designed for a wide range of applications with a 30 GB M.2 SSD, 2 GB of DDR3L RAM (expandable to 4 GB), one DisplayPort, one on-board dual Ethernet adapter with 2 x 100/1000Base-T connectors, one USB 3.0 port, and one USB 2.0 port. Overall, the C6015 is likely the first Industrial PC on the market to offer such a high performance density paired with all the interfaces needed in a machine design.

C6015: Popular for use as an IoT gateway

Beyond its typical use case as control hardware for automation and visualization tasks, the success of the C6015 is also largely based on IoT applications. About half of the devices installed to-date are being used for communications purposes in IoT applications. These may include something as simple as the collection, processing and provision of process data or more complex tasks that are typical of an IoT gateway. The Microsoft Azure™ certification of the C6015 underscores that it is an ideal device for Industrie 4.0 applications.

The C6015 is well-matched for such communication tasks, including connectivity with legacy systems, because it makes it easy to add IoT capabilities to existing machines and get them ready for future communication requirements — either as an IoT gateway or a basic data collection device.

C6030: Building on a successful concept with high-end computing power

Beckhoff is continuously adding models to its family of ultra-compact and flexible Industrial PCs. At the 2017 SPS IPC Drives trade show, for example, the company unveiled the high-end C6030 with processors of the most advanced performance class. This is because the innovative concept introduced with the C6015 also quickly impressed users with automation, visualization and communication applications who have requirements that go beyond the medium performance range.

The C6030, which is also Microsoft Azure™ Certified, advances the design of the C6015. In addition to dual-core Intel® Celeron® and Pentium® CPUs, 6th and 7th Generation Intel® Core™ i processors are available. This is possible because of a new cooling concept based on a durable speed-monitored and controlled fan with dual ball bearings. With dimensions of 132 x 132 x 67 millimeters, the computer is nearly half the size of the closest comparable C6930 control cabinet IPC. The C6030 also offers more standard interfaces even in the basic configuration: an on-board Ethernet adapter with four 100/1000Base-T connectors, four USB 3.0 ports, and two DisplayPorts. It also features two easily accessible slots for M.2 SSD drives (incl. optional RAID controller). Depending
on the selected configuration, the C6030 costs up to 34 percent less than a comparable IPC from the C69xx family.

With processors ranging up to the Intel® Core™ i7 with four cores running at 3.6 GHz and the Core™ i3 with two cores running at 3.9 GHz, the C6030 delivers what may be an unprecedented level of performance in such a compact format. As a result, the successful concept of ultra-compact Beckhoff IPCs has now become available even for very large and complex machine control applications. This can include CNC, XTS and HMI applications, multi-axis control, as well as applications with extremely short cycle times and large data volumes. For legacy equipment, the C6030 can serve as a powerful replacement in control platform retrofits and go well beyond the capabilities of alternate systems. With such a high level of performance, the C6030 can easily handle all machine automation and visualization tasks as well as all IoT operations. Just like the C6015, the user benefits from an exceptionally flexible installation concept with vertical and horizontal back wall mounting and totally free positioning of the IPC within the mounting frame.

Use cases for the ultra-compact IPC with IoT gateway functionality: As a fully functional machine controller incl. support for PLC, HMI, IoT and more (left), as well as an affordable IoT or edge device for retrofit applications (center), or both for new installations and retrofits in conjunction with third-party control systems (right).

The ultra-compact Industrial PCs (shown here: C6015) feature a very flexible installation concept, and with all interfaces located on the same side, enabling the free orientation of the connector level even if space is highly limited.
The ultra-compact C6015 IPC has been quickly established on the market, particularly in IoT applications. What concrete application examples can you discuss, and why wouldn’t companies use their existing PC infrastructure for these tasks?

Roland van Mark: All IoT applications require PC hardware in addition to appropriate software. With PC-based control technology from Beckhoff, these hardware and software components are already integrated, of course, so that the control platform is ideal to support today’s applications. We nevertheless see many instances where customers want to separate the actual automation functions from IoT communication. This is particularly true for legacy systems and applications. Some customers prefer to leave an existing application untouched and add a kind of gateway PC to transmit IoT data instead. It doesn’t matter whether the system is implemented with TwinCAT or another automation platform. With the extensive features already described, the C6015 IPC provides an ideal platform for all these needs.

“Among other things, the C6015 is ideal for use as a gateway PC that enables a separation of automation and IoT communication applications.”
The application spectrum of the C6015 extends even to large projects. What applications are these?

Roland van Mark: Basically the same as what I described above. The only difference is whether our customer uses the C6015 as a gateway for all previously installed machines. The latter is becoming more and more common and brings the C6015 to the machine as a universal IoT gateway, either equipped with Beckhoff IoT software (such as TwinCAT OPC UA Server or TwinCAT Data Agent) or with the customer’s own IoT software.

What are potential or current applications for the high-end C6030 IPC compared to the applications you already mentioned?

Roland van Mark: Although the C6030 is very similar to the C6015 in terms of appearance, compactness and incredible installation flexibility, it is targeted towards very different applications. The C6030 houses the most powerful industrial Core™ i processors in the smallest space. Never before has Beckhoff offered so much computing power in such a compact format. It also costs much less than all previous models that offer comparable performance. With all these benefits, the C6030 may over the long term become the most important automation computer for PC-based control applications. With its flexible installation options, it is also suitable for applications where space is limited. In addition, its low-cost, entry-level processors make it available for price-sensitive applications, and its many on-board interfaces and optional high-performance processors running at speeds of up to 3.9 GHz per core make it ideal for even the most demanding applications.

You will be adding the C6017 to the series at Hannover Messe 2018. What are this new device’s features, and how is it positioned in relation to the other ultra-compact IPCs?

Roland van Mark: Immediately after the introduction of the C6015 we heard from customers who loved the concept but needed additional features. Since we had anticipated such requests, we designed the motherboard with future expandability in mind. We collected these customer requests and are now offering expansion options in the form of the C6017. It still features ultra-compact design and maximum installation flexibility, but offers additional interfaces (2 x RJ45, 2 x USB 2.0) and a 1-second UPS.

How will the family of ultra-compact Industrial PCs be expanded further?

Roland van Mark: As a supplier of Industrial PCs, you must be able to meet your customer’s requirements on a continuous basis, because the IPC is at the core of the customer’s automation applications. This is why the C600x series from Beckhoff is strategically designed to meet future requirements regarding miniaturization, installation flexibility, long-term reliability and cost-effectiveness. At the same time, customers also want to have a high degree of application flexibility because not all machines are alike, and new tasks may differ substantially from previous ones. Accordingly, you can expect more interfaces to be added to the C6030 in the future as well.

“In the C6017, we now provide expansion options to our customers that we already anticipated when designing the motherboard with future expandability in mind.”
EtherCAT® P

Drive Integrated
AMP8000 Distributed Servo Drive system for modular machines

**Integrated drive technology minimizes control cabinet space and optimizes machine design**

The AMP8000 distributed Servo Drive system provides ideal support for the implementation of modular machine designs. For this purpose, a servo drive has been directly integrated into a servomotor, all in a highly compact design. In this way, the power electronics are relocated to the machine, reducing space requirements in control cabinets to just a single coupling module. In addition, decentralized distribution modules and the universal EtherCAT P solution further optimize the modular machine design approach.
The AMP8000 system is highly modular and cascadable – it consists of the AX883x or AX503x coupling modules, the AMP8805 distribution module and the AMP80xx distributed Servo Drives.

The AMP8000 system consists of three main components: a single-channel or alternately dual-channel coupling module that forms the starting point, and is the only component that still needs to be installed in the control cabinet. The coupling module establishes a connection between the DC link, 24 V DC supply and EtherCAT communication. For use with the high-performance AX8000 multi-axis servo system from Beckhoff, the AX883x coupling module is connected to the AX8000 supply module in order to provide a link to the IP 65-rated devices with one or two outputs. In combination with the AX5000 Digital Compact Servo Drive, the AX503x coupling module can also be used in stand-alone mode due to an integrated power supply unit. In this way, 20 A (per output in the case of the AX883x and as sum current in the case of the AX503x), 600 V DC link voltage, 24 V power supply and EtherCAT networking are available via the EtherCAT P outputs (B23 sockets).

This power is initially supplied to an AMP8805 distribution module as a second system component. As an IP 65-rated component that is integrated into the machine layout, it supplies up to five AMP800x distributed Servo Drives. It can be mounted either directly ("brick style") or using a bracket available as an accessory ("book style") and adapted ideally into individual machine designs. The distribution module has an internal capacitance of 1120 µF to support the DC link. Additional EtherCAT P Box modules, such as for I/Os or for a second feedback system, can be connected simply and quickly via an additional EtherCAT P M8 output.

The third system component is the AMP80xx distributed Servo Drive. It is identical to the standard servomotors in the AM8000 series with regard to its mounting dimensions and performance data. Only the overall length has increased in comparison with the standard motors due to the integrated power electronics. Since this added length is not usually critical for the installation, most existing machine designs can be upgraded without the need for modification. The AMP800x distributed Servo Drives are initially available in the flange sizes F4 and F5. Various versions are available with rated outputs of 0.61 to 1.18 kW and standstill torques of 2.0 to 4.8 Nm (F4) or rated outputs of 1.02 to 1.78 kW and standstill torques of 4.1 to 9.7 Nm (F5). The STO and SS1 safety functions are integrated as standard and a range of extended safe motion functions are currently being prepared. In addition, the new flange sizes F3 and F6 are in development and will complement the AMP8000 distributed drive system in the lower and higher power ranges.

**Universal cabling and cascadable installation via EtherCAT P**

The components in the AMP8000 system are universally connected with the uniform One Cable Automation (OCA) cabling technology, which connects via identical cross-sections and connectors. This is a dynamic, drag-chain compatible EtherCAT P cable with ECP-B23 connectors, which means the one cable solution features a hybrid cable that combines EtherCAT P (communication plus 24 V system and peripheral voltage) with additional power cores. Moreover, preassembled cables and connectors facilitate easy installation and minimized errors during cabling.

The AMP8000 system is also cascadable via the distribution module, meaning even highly complex machines and plants can have a simple and clear-cut topology layout. For this purpose one or several additional distribution modules
The AMP8000 distributed Servo Drive system is ideal for implementing modular machine designs with easily installed extension modules.

are connected to one of the module outputs in place of a distributed servo drive. For example, one main distribution module can supply five sub-modules, to which a maximum of 25 distributed servo drives can be connected, assuming an adequate supply of power to the individual motors is provided.

Compact drive integration in optimized design

With the AMP80xx, the integration of drive technology has been implemented in an exceptionally compact design, made possible through the use of the latest output stage technologies. The power module is attached at the rear end of the servomotor shaft, ensuring that the attachment dimensions are identical to those of the corresponding standard servomotors in the AM8000 series. Only the overall length is about seven centimeters larger. For machine builders, this means only a small amount of additional space is required, making it possible to switch between drive concepts without any fundamental design modifications.

Apart from the small overall volume, the elegant and slim design of the AMP80xx offers further advantages over certain servomotors commonly encountered on the market, where the power electronics are mounted on top. With the AMP8000, the two dissipated heat sources – motor and power electronics – are clearly separated from each other and ensure much better heat dissipation by design, without the need for additional installation space or heat sinks. As a result, the distributed servo drives easily attain the same excellent properties as the corresponding standard AM8000 servomotors.

Further information:
www.beckhoff.com/amp8000
Andreas Golf: The distributed drive system was specially developed with the goal of reducing cable lengths, because the components no longer have to be mounted so far apart. The maximum number of axes is only limited by the current load. However, with our Motion Designer software it is very simple to verify whether a given configuration is viable in the field or not. Here, the total load for the power supply unit is calculated on the basis of a specified work cycle and suggestions for a system expansion are given if possible. The maximum extension with regard to cable lengths can also be checked easily.

How big are the potential savings in terms of cabling and assembly effort for a typical AMP8000 application?

Andreas Golf: As the basis for calculation let’s use an average number of axes of eight motors per machine and assume that a control cabinet is on average 15 meters away from the machine. These eight motor cables are now replaced by a single OCA cable. If you then add two of the distribution modules required
for the AMP8000 system and eight short cables supplying the distributed motors, the costs are about 10 to 15 percent lower for the distributed drive solution depending on the configuration. In addition, there are the advantages of smaller control cabinets and a closer positioning of the drive technology to the machine, resulting in further savings potential.

What are your plans for the future rollout of the AMP8000 system?

**Andreas Golf:** The AMP8000 distributed Servo Drive system will be expanded in both the lower and upper ends of the power scale. The system is already suitable for outputs up to 3.5 kW; the currently available flange sizes F4 and F5 will be supplemented by their corresponding counterparts in the flange sizes F3 and F6. The principle of the 600 V DC supply will also apply to these drives and provides machine manufacturers with maximum flexibility. A distribution module optimized for a higher numbers of axes with 10 connections will also be developed.

The AMP80xx distributed Servo Drives were presented for the first time at the SPS IPC Drives trade show in 2017 – initially in flange sizes F4 and F5.

The AMP8805 distribution module is equipped at the front with a power input and five power outputs – each with an EtherCAT P B23 socket – as well as with an EtherCAT P M8 interface for the connection of EtherCAT P I/Os.

Andreas Golf during the introduction of the AMP8000 series at SPS IPC Drives 2017: “The AMP8000 system gives machine builders full freedom to choose between conventional or distributed drives without having to modify the machine design.”

Further information:
www.beckhoff.com/amp8000
The EL9227 overcurrent protection terminals convince with integrated condition monitoring capabilities and enable an increased system availability and reduced costs at the same time.

System-integrated overcurrent protection in the EtherCAT I/O system

In the EL922x EtherCAT Terminal series, Beckhoff has directly integrated electronic overcurrent protection to safeguard 24 V DC system components in the highly compact EtherCAT I/O system. In comparison with currently available protection devices, costs and space requirements in control cabinets can be reduced without having to use a conventional, inflexible stand-alone system. With an extended range of settings and process data options, the EL9227 EtherCAT Terminals meet the most diverse requirements and enable transparent system monitoring.

The EL9227 overcurrent protection terminals

The new EL922x Terminal series for overcurrent protection is designed for 24 V DC operation and includes 19 different EtherCAT Terminals. There are 1- and 2-channel versions for various current loads up to a maximum of 10 A. Furthermore, the wide range of terminals is divided into:

- EL9221 and EL9222 Terminals with standard functionality such as rated current, which can be parameterised not only in TwinCAT system configuration, but also conveniently using an LED button, and
- EL9227 Terminals with extended functionality that can be parameterised using TwinCAT system configuration software, such as the selection of a characteristic curve, preliminary warning threshold, undervoltage signal, feedback cut-off, event logging and a password-protected software seal.

System-integrated overcurrent protection offers numerous practical benefits for users. Wiring effort is reduced, since the feed into adjacent I/O terminals is achieved automatically by simply plugging in the terminal. In addition, control cabinets benefit from space and cost savings because additional coupling hardware and other digital I/O or power feeding products are no longer required. Furthermore, numerous types of process data can be accessed via EtherCAT, for example utilisation rate, load current, input/output current, undervoltage/overvoltage and feedback. This enables transparent system monitoring, minimised downtime, simplified troubleshooting and a comprehensive overview of plant history.

Further information: www.beckhoff.com/el922x
Simple, flexible and cost-effective machine safety implementation

IMA Klessmann GmbH of Lübbecke, Germany is an international manufacturer of trend-setting manufacturing machines for the woodworking and craft furniture industries. In 2017 the company modernized a complex, multi-track transport system for wooden workpieces for one of France’s largest kitchen cabinetry manufacturers, Fournier SA of Thônes. In the process, a reliable monitoring system that prevents unauthorized entry was implemented in an extremely simple, flexible and cost-effective way using analog sensors and TwinSAFE SC safety technology (TwinSAFE Single Channel) from Beckhoff.

In the plant area concerned, board-shaped workpieces for kitchen furniture are removed from a sorting warehouse and stacked on pallets in two picking stations according to job lists. The finished stacks are subsequently transported out of the order-picking areas via appropriate conveying equipment to the downstream machines. Following destacking, these machines then receive the necessary parts in precisely the right order to assemble a kitchen cabinet as efficiently as possible. The two picking stations, which are among the safety risk areas due to their operating principle, each have six gates to discharge the workpiece stacks.

According to Michael Gube, software developer at IMA and responsible for the startup of this project, the requirement for this kind of application is that it must never be possible for a human to enter the risk area. There is a high safety risk involved on account of the high dynamics of the transport portals located in this area and the large masses that are moved. The conventional method to control access to such plant areas is to use safety light barriers and muting functions. However, such measures alone were deemed insufficient in this case. For structural reasons the safety light barriers could only be installed immediately before the risk area. Unauthorized entry would be reliably detected by the light barriers, but there would not be sufficient time to stop hazardous movements quickly.
enough, even if the maximum possible braking ramps were activated. Other measures, for example the use of safe service brakes, would place an extreme load on the mechanical system and in the long term once again represent a safety risk while endangering the process safety.

Two-stage safety concept provides solution
One of the requirements, therefore, was to guarantee personal and process safety through a second safety device: If anyone attempts to gain unauthorized access to the picking area, they must pass through two devices: as soon as they pass the first, the portal switches to the Safely Limited Speed (SLS) mode. As the person approaches the second device, the machine is stopped from the safe speed.

The first safety device consists of three standard transit time sensors. There is always a safety risk when there is either no material stacked in the area of these sensors or when the material stack is not moving in this area. The entry risk during this phase is reliably avoided the following way: As soon as a board stack moves underneath the transit time sensor area and is subsequently stopped, the transit time sensors measure the current stack height once (latch). If the stack moves completely out of the area, the stack height is given the value 0.

The stacks of wooden workpieces for kitchen furniture from Fournier are supplied by two systems, each with six roller conveyors.
The values of the three sensors determined at a standstill are transmitted to the safety controller and continually compared to the actual values of the transit time sensors. Now if someone attempts to gain entry when no stack is present or by climbing over a stationary stack, at least one of the three actual values deviates from the latched position. This immediately causes the portals to switch to Safely Limited Speed (SLS) mode.

Once a person has overcome the first safety device, he or she must additionally overcome the second set of devices, safety light barriers placed immediately in front of the picking area. If they detect entry, then the axes which are already moving at a safely limited speed are finally brought to a standstill.

**Analog value processing saves considerable costs**

For Michael Gube, the prerequisite for an efficient safety solution was the analog signal processing capability of the EL6910 TwinSAFE Logic terminal: "Previously there was a safety deficit on this machine, even though the roller conveyors were manufactured to be inaccessible. However, access was still possible in individual cases, for example if only a base plate normally used underneath a stack was transported. The safety light barriers used for protection were too close to the moving portal, which meant it couldn't be stopped fast enough in case of imminent danger. The initial solutions considered, such as safety doors or the use of radar scanners, would only have been possible with considerable
mechanical rework and cost expense. The alternative with TwinSAFE SC and transit time sensors proved considerably simpler and more flexible for us, while being much more cost-effective."

**Safety function blocks for analog sensor signals**

According to Michael Gube, the safety functions based on the analog signals from the transit time sensors can be implemented very conveniently in TwinCAT 3 software with the appropriate safety function blocks which are above all extremely scalable. The complexity of the system is also not a problem. It consists of two machines with identical hardware and software, each of which makes use of a Beckhoff CX9020 Embedded PC, an EL6910 TwinSAFE Logic terminal and six EL3124-0090 TwinSAFE SC analog input terminals (one for each roller conveyor). Bettina Keller, application/support from Beckhoff, adds: “In addition, each machine uses four EL1904 TwinSAFE digital input terminals for the safety acknowledgement and dual-channel muting inputs and one EL2904 TwinSAFE digital output terminal to control the safety contactors. All necessary functions such as the maximum permitted duration of a muting procedure can be configured conveniently with TwinSAFE function blocks in TwinCAT.”

That is also confirmed by Michael Gube: “The most diverse safety functions can be realized simply and quickly with the safety function blocks. A particular advantage of this is that it applies universally, even to the more complex analog input signals.”
TwinSAFE SC technology (TwinSAFE Single Channel) permits the use of standard signals for safety tasks in any network or fieldbus. To do this, the data from the EtherCAT Terminals, extended by the TwinSAFE SC function, are fed to the EL6910 TwinSAFE Logic terminal, where they undergo safety-related multi-channel processing.

Data from various sources are analyzed, checked for plausibility and evaluated within the logic, although for safety reasons at least one of the data sources must be a TwinSAFE SC component. The remainder of the data can originate from standard I/Os, drive controllers or measuring transducers. As a result, all of the process data present in the system can be used for safety technology. In this way TwinSAFE SC technology opens up completely new possibilities in the world of Beckhoff systems and offers a simple, efficient and inexpensive means to fully integrate all safety tasks into existing infrastructures.

With the help of the TwinSAFE SC terminals, the EL6910 TwinSAFE Logic terminal can also evaluate standard signals for safety tasks.

**TwinSAFE SC integrates standard signals into safety technology**

TwinSAFE SC technology (TwinSAFE Single Channel) permits the use of standard signals for safety tasks in any network or fieldbus. To do this, the data from the EtherCAT Terminals, extended by the TwinSAFE SC function, are fed to the EL6910 TwinSAFE Logic terminal, where they undergo safety-related multi-channel processing.

Data from various sources are analyzed, checked for plausibility and evaluated in the TwinSAFE Logic. Certified function blocks are available for this, such as e.g. scaling, comparison/evaluation (1oo2, 2oo3, 3oo5) and limiting. For safety reasons one of the data sources must be a TwinSAFE SC component. The remainder of the data can originate from standard I/Os, drive controllers or measuring transducers. As a result, all of the process data present in the system can be used for safety technology. In this way TwinSAFE SC technology opens up completely new possibilities in the world of Beckhoff systems and offers a simple, efficient and inexpensive means to fully integrate all safety tasks into existing infrastructures.

**Demand-based solution is scalable, yet integrated**

The fine scalability of PC-based control technology from Beckhoff resulted in one of the biggest advantages in the installation of the new safety solution, as Michael Gube explains: “The entire production facility is controlled by TwinCAT 2 software. However, the TwinCAT 3 software generation is required to directly connect the analog sensors via the EL6910 TwinSAFE Logic terminal. The modular Beckhoff control technology is scalable to suit the application demands and it allowed this by simply and cost-effectively realizing new safety functions via a subsystem that consists of the CX9020 Embedded PC with TwinCAT 3 as well as the TwinSAFE and TwinSAFE SC terminals.”

This solution has proven to be extremely flexible in a further regard for Michael Gube: “According to the applicable safety regulations, the hazardous area must be monitored over its entire width in 250 mm intervals. Therefore, we use three transit time sensors on each of the 700 mm-wide roller conveyors. If it should prove necessary in the future to use wider roller conveyors due to larger workpieces, we only need to increase the number of sensors accordingly. The adaptation of the safety functionality can then be configured with little effort via TwinCAT software, especially since safety engineering under TwinCAT 3 is very convenient and efficient.”

**With the aid of the TwinSAFE SC technology it is typically possible to achieve a safety level equivalent to PL d/Cat. 3 in accordance with EN ISO 13849-1 or SIL 2 in accordance with EN 62061. The following TwinSAFE-SC-EtherCAT Terminals from the fields of analog input, position (angle/displacement) measurement and communication are currently available to achieve this:**

- EL3124-0090: 4-channel analog input terminal 4…20 mA, differential input, 16-bit
- EL3214-0090: 4-channel analog input terminal, PT100 (RTD) for 3-wire connection
- EL3314-0090: 4-channel analog input terminal, thermocouple with open-circuit recognition
- EL3124-0090: 4-channel analog input terminal, 1 Vpp
- EL5021-0090: Incremental encoder interface
- EL5101-0090: Incremental encoder interface
- EL6224-0090: IO-Link terminal

In addition to these there is the EP3174-0092 EtherCAT Box, which is a 4-channel analog input (±10 V or 0/4…20 mA, differential input, 16-bit) with IP 67 protection for decentralized installation directly on the machine.
Example application for safe level measurement with TwinSAFE SC (category 3, PL d):
This shows how the level measurement in a container can be implemented with TwinSAFE SC technology. Two different measurement methods are used for this. First, an ultrasound sensor with a 0…10 V interface wired to an EP3174-0092 TwinSAFE SC EtherCAT Box and second, a level probe with a 4…20 mA interface wired to a standard EL3152 EtherCAT Terminal. These two signals are compared or checked for plausibility by means of a Compare function block within the safe EL6910 TwinSAFE Logic terminal. The signal from the EP3174-0092 EtherCAT Box is scaled by the Scale function block first so that both signals have an identical value range. Subsequently, the signal is checked by the Limit function block. The results of the Limit function block and the IsValid output of the Compare function block are used via the Mon function block to switch off the contactors K1 and K2. In addition, the StuckAtError output of the Scale function block can be connected to a Mon input. Therefore, unwanted freezing of the signal can be detected. To keep things clear the contactor control is not shown in this overview, but the user should keep it in mind.

Example application for safe temperature monitoring with TwinSAFE SC (category 3, PL d): Here, two measuring points are equipped with temperature sensors, one with a type K thermocouple (wired to a standard EL3312 EtherCAT terminal) and the other with a PT1000 measuring resistance (wired to an EL3214-0090 TwinSAFE-SC-EtherCAT Terminal). These two signals are compared or checked for plausibility by means of a Compare function block within the safe EL6910 TwinSAFE Logic terminal. Subsequently, the signal is checked by means of the Limit function block. The results of the Limit function block and the IsValid output of the Compare function block are used via the Mon function block to switch off the contactors K1 and K2. To keep things clear the contactor control is not shown in this overview, but the user should keep it in mind.

Further information:
www.ima.de/en/
www.beckhoff.com/twinsafe-sc
Machine evolution yields higher efficiency and quality in processing
Dentsply Sirona provides advanced products and solutions for dentists and dental technicians around the world. As the company’s internal equipment division, the Advanced Technology Group sets the foundation for innovative and high-quality offerings. One example is the new IM4P grinding machine for dental drills, which was developed in 2017. Through the use of TwinCAT CNC software, the advanced machine features a faster and more stable grinding process than its predecessor. It also reduces tool wear, and requires only half the typical adjustment time for product changeovers.

With over 15,000 employees, 800 of whom work at the company’s location in Ballaigues, Switzerland, Dentsply Sirona has been making dental products since 1877. It invented the electric dental drill and developed the first bulk fill composite and the first partial matrix, which makes direct dental restorations faster and easier. The company is also a leader in the development of dental implants and digital tools for safer and more efficient patient care.

François Aeby, who heads the Advanced Technology Group, explains its role as follows: “Our goal is to provide efficient and customized high-tech machinery for all Dentsply Sirona production sites around the world. The reason for this approach is to keep core expertise in-house while supporting customers and their product development activities with new processes and technologies.” To do this, the Advanced Technology Group focuses on four main areas: dental labs, process automation, automatic inspection and packaging systems.

**Major improvements in drill grinding machine**

The new IM4P grinding machine for dental drills represents a major evolutionary step compared to its predecessor, says François Mottier, project manager at Dentsply Sirona. “Using TwinCAT CNC simplifies the machine’s commissioning process and improves its machining quality. It also makes changeovers between the various drill types easier and more flexible. Changing the product now involves only changes in software without having to replace any mechanical components.” François Aeby adds: “This also applies to conversions to other application areas. For example, the same CNC functionality can be used to produce dental milling cutters in the future. All we need to do is to adjust the tools accordingly.”

The grinding machine consists of four modules, each with five interpolated axes and one virtual CNC axis, says Daniel Roy, automation engineer at Dentsply Sirona. “Controlled via TwinCAT CNC, the five
The One Cable Technology of the AM8100 servomotors reduces required cabling and connectors, installation time and space.
axes position the tool with maximum precision and move a trolley that holds the various machining tools. There is also a tool table that moves with the same axes and an additional spindle. The virtual axis, which is a combination of the x- and y-axes, is a function provided by the TwinCAT CNC system.

**Improved control performance for higher machine efficiency**

Due to the need for greater performance, Dentsply Sirona employs TwinCAT CNC for the new grinding machine model. The TwinCAT 3 system comprises the following CNC functions:

- TC3 CNC Basic Pack (including TC3 PLC/PTP/NCI).
- TC3 CNC Axes Pack for a total of 64 axes/controlled spindles, of which 32 can be path axes and 12 can be controlled spindles
- TC3 CNC Channel Pack for extending another CNC channel to a maximum of 12 channels
- TC3 CNC Transformation with 5-axis functionality, kinematics library, RTCP and TLP functionality, and the definition and/or chaining/transition of various coordinate systems

Daniel Roy believes that TwinCAT CNC delivers several benefits. “It makes the machine faster overall while reducing grinder wear and delivering faster process execution. We also use the software to generate programs for curved path control more efficiently, either with code programmed manually or via interpolation. The automatic mechanical correction function, i.e. the possibility to rule out axial non-linearities with TwinCAT CNC, also played a major role in the decision process. Other functions like offset compensation played a critical role in reducing the conversion time between two production series, which was cut in half from three hours with the previous model to one-and-a-half hours today. With additional improvement and more operator training, we expect this time to be cut even shorter in the future. In addition, the operator interface is much more user-friendly, which makes inspections and machine monitoring operations much easier than ever before,” Daniel Roy points out.

**Open all-in-one automation in single unit**

Dentsply Sirona has employed PC- and EtherCAT-based control technology from Beckhoff since 2003, all with great success. Daniel Roy recalls: “We were mostly looking for a system that would integrate axis control functions seamlessly and without separate control hardware. It also had to be able to accommodate third-party components. Such an all-in-one automation solution with PLC and NC functionalities was only available in PC-based control systems from Beckhoff. In addition, Beckhoff Industrial PCs (IPCs) are extremely powerful. For example, a C6920 IPC with a quad-core Intel® Core™ i7 processor is all you need to control the entire IM4P machine – including all four machine modules, tool handling via PLC functionality and integrated safety functions.”

François Mottier points out another aspect: “EtherCAT also delivers many benefits for us. It is extremely powerful, making it ideal for data transmission to the drives. And since it has become an established industry standard, many different devices can be easily integrated. The same applies to the machine’s safety requirements, which are well-covered by Safety-over-EtherCAT and TwinSAFE. This includes the emergency STOP function, the protective doors, and the drive safety functions for the motion axes. According to François Mottier, PC Control also enabled an exceptionally space-saving design of the IM4P’s handling system: “The handling functions of the IM4P, such as the loading and unloading operations, are implemented via a total of seven servo axes. Here we benefit from an extremely compact design, enabled by the EL7211 servo drives in terminal block format, designed for use with the AM8100 servomotors equipped with One Cable Technology (OCT)."
EtherCAT plug-in modules help optimize electronics production

Customer-specific I/O level promotes highly efficient machine construction

Mühlbauer GmbH & Co. KG based in Roding, Germany, builds specialized machines used in the fields of chip card and passport production as well as in the semiconductor industry. The company creates a clear competitive advantage with a high degree of standardization in machine construction. The EJ series EtherCAT plug-in modules, in conjunction with a customer-specific signal distribution board, ensure significant reductions in errors and the time required to manufacture machines. This also results in reduced manufacturing costs and accelerated delivery times for the new DS Merlin die-sorting system.

In the DS Merlin, numerous complex processing workflows could be implemented in space-saving design.
Mühlbauer is an innovative and globally operating company that covers the entire spectrum of safety applications, ranging from simple production parts to complex production lines and turnkey solutions, including building and safety planning. Martin Dimpfl, Head of Electronic Engineering in the automation division, explains: "The automation division at Mühlbauer focuses on machines for semiconductor finishing, RFID and tag manufacturing, ID card and passport production, personalization machines for documents and bank cards, as well as complex inspection systems. This includes the new DS Merlin die-sorting system, which can process up to 30,000 dies per hour – including complete vision inspection for possible defects. In addition to the considerable increase in throughput from 20,000 to 30,000 chips/hour, simplified machine setup and operation, as well as improved wafer handling, it was also possible to reduce costs by 20 percent compared to the previous machine model.

With up to 30,000 dies per hour, the DS Merlin die-sorting system from Mühlbauer can process significantly more semiconductor components than its predecessor model.
The standardization of the I/O system with EtherCAT plug-in modules from Beckhoff was a key contributing factor to these achievements."

The DS Merlin can process microchips up to a size of 0.2 x 0.4 mm and a thickness of 80 µm with maximum precision and speed. The respective wafer is measured, and the placement or size of the individual chips is recorded. The machine then automatically corrects the transfer of the semiconductor devices to the individual pick-and-place units. The advantage, Dimpfl says, is that "up to now, all this had to be implemented by the machine operator via teach-in. This whole effort has been eliminated."

**Modular and compact machine designs**
The machine is divided into different function modules. The automatic wafer changer first transports the wafer onto a table and then transports the processed semiconductor wafers back into a wafer cassette. The wafer table expands, rotates and moves the wafer during production. It then positions...
the wafer in such a way that the following die ejector (chip removal unit) can transfer the individual microchips to the upper of two inspection wheels, where the wafer film is held in position by a vacuum around the die ejector needle. All six microchip sides are 100 percent checked on the two inspection wheels. A counting module then positions, transports and seals the belt with the chips placed in it with the cover band and carries out final inspections. Once the desired quantity has been reached, the belt is cut off.

This advanced machine was designed to be highly modular and compact, says Dimpfl. “For this reason, four different signal distribution boards with EtherCAT plug-in modules are used in the DS Merlin, for example. The main reason for introducing the new I/O concept was the significantly reduced wiring effort. This has a very positive effect on error reduction and, above all, on manufacturing time and costs.”

**Maximum I/O installation efficiency using EJ modules and custom-designed boards**

The four signal distribution boards are precisely matched to the Mühlbauer machine’s requirements and, according to Martin Dimpfl, go far beyond simple I/O signal distribution. In addition to the EJ modules, EtherCAT Servo Drives for piezoelectric and piezo-ceramic motors, flashlight controllers and logic for vision applications, as well as the complete 24/48 V voltage distribution are also included. A total of 26 EtherCAT plug-in modules are used, with digital and analog inputs/outputs as well as an incremental encoder interface, stepper motor module and bus power supply unit. “Our goal was to minimize the wiring effort within the machine and to place the signal distribution board as close to the respective components as possible. This results in an extremely compact design, and the complete wiring and testing of the unit can be carried out in the pre-assembly phase. Thus, the times for testing, production and commissioning are reduced throughout,” Dimpfl points out.

Dimpfl also sees a great advantage in the breadth and consistency of PC-based control technology. “With the comprehensive product portfolio from Beckhoff, the right control solution is available for every machine process. In addition, EtherCAT plug-in modules add another advantage to the time savings and error reductions mentioned above. Through consistent support for EtherCAT communication, they can be easily combined with the wide range of available EtherCAT Terminals. This increases our flexibility immensely, as additional customer requirements – such as the integration of special sensors or special test systems – can be implemented quickly and easily based on the same basic machine,” he summarizes.

The EtherCAT plug-in modules from the EJ series can be used in combination with the appropriate signal distribution board to efficiently implement application-specific I/O systems.

**Advantages even for small series production starting at 10 machines**

As a specialized machine manufacturer, a modular system is indispensable for Mühlbauer because this is the only way to achieve the necessary standardization needed to use basic assemblies efficiently in different machine types, and to eliminate the need for a complete redesign for each machine. Martin Dimpfl explains: “According to our calculations, the use of EtherCAT plug-in modules – including the development of the signal distribution board – already returned the investment for a small series of around 10 machines per year. As the functionality of the boards is fully tested in advance, we achieve an enormous reduction of the error rate during assembly, resulting in smooth commissioning. In the case of the DS Merlin, this saves approximately 100 hours of installation time, plus additional time saved that was previously spent on troubleshooting and debugging. Accordingly, we will successively convert all relevant machine types in our portfolio in the future, which comprises more than 200 systems with more than 10 machines per year, to the Beckhoff EJ system.”

Further information:

[www.muehlbauer.de](http://www.muehlbauer.de)
Beckhoff India celebrates its 10th anniversary

The Beckhoff subsidiary in India recently celebrated its 10th anniversary. In an interview with Hans Beckhoff, company founder and Managing Director of Beckhoff, Kai Ristau, Head International Sales and Business Development, and Jitendrakumar Kataria, Managing Director of Beckhoff India, the PC Control editorial team asked for some background information on the business growth of Beckhoff on the Indian market.

What made you decide to found Beckhoff India 10 years ago?

Hans Beckhoff: We realized relatively early on that internationalization would be an important prerequisite for our continued growth as an automation company. When we started to build up sales structures in the most important industrial nations in the late 1990s, we also took a closer look at India. After the first positive experiences we made in cooperation with a local business partner, we decided to establish a subsidiary in Pune in 2007.

To what extent do you think PC-based automation is well accepted in India?

Hans Beckhoff: When Beckhoff developed the concept of PC-based machine control in the mid-1980s, this was a real revolution, and in the beginning, the industry responded rather skeptically. However, there were also innovative machine builders who recognized the true potential of this pioneering technology and took advantage of the benefits in order to expand their position among the competition. Today, PC-based control systems are widely accepted and have proven their superiority over conventional control systems in many applications and industrial sectors worldwide. As far as the Indian market is concerned, we see a great deal of openness towards innovative technologies and a desire to stand out from other market participants. Consequently, PC-based machine control systems are gaining momentum in India, and as it turns out, it was the right decision for Beckhoff to invest in India.

What were the first steps taken to establish the subsidiary in India?

Kai Ristau: We took our first steps on the Indian market in 2001 with distribution partner Inteltek Automation. In parallel to the dynamic development of Indian industry, there was rising interest in innovative technology from Germany, which gave us a basis on which we were able to build. Due to the positive business development that ensued, we decided to strengthen our commitment in India and to establish a subsidiary based in Pune.
How has Beckhoff India developed over the past 10 years?

Kai Ristau: In 2007, we started up in Pune with a team of five employees. Jitendrakumar Kataria, who had previously worked in our software development department in Germany, was appointed as the managing director: a young engineer with excellent knowledge of automation technology, but also with all the skills required to build up a company. Over the years, with the support of his team, he has been able to establish a dense sales network on the geographically extensive Indian market. Beckhoff India currently operates seven local offices and has a team of 60 experienced and highly motivated automation engineers and administrative staff. Based on the competent technical support and the availability Beckhoff offers its customers, we succeeded in establishing stable and trusting business relationships.

What role does automation technology play for industry in India?

Kai Ristau: Automation technology is important for all industrial nations with development potential, and India is no exception. As far as the Indian consumer market is concerned, it is characterized by a young population and a strongly growing middle class. This means that the demand for consumer products is growing rapidly. In order to meet this demand, highly automated machines are required: The automation industry not only increases productivity and product quality, but also optimizes resource consumption and thus forms the basis for competitive production. In order to be able to export worldwide, Indian mechanical engineering companies also require automation and control concepts that comply with globally applicable standards and current best practices. In our opinion, a country that is regarded as a hub for IT technology, research and production also fulfils all the prerequisites for becoming a hub for open PC-based automation.

What challenges did you have to overcome when setting up the subsidiary?

Jitendrakumar Kataria: When founding Beckhoff India, the first task was to build up a good team, i.e. all employees had to be trained in Beckhoff technology and products. At the same time, it was important to understand the Indian market and to find starting points in order to inspire machine manufacturers with enthusiasm for our technology and to win their trust. The next step was to open additional locations to be within our customers’ reach geographically and to provide better and faster technical support. We also set up a service center at our headquarters in Pune, which enables us to provide service in a prompt and timely fashion.

What do you see in the future for Beckhoff India?

Jitendrakumar Kataria: It is our vision to establish “Made by India” as a quality standard by raising mechanical engineering to a new level with Beckhoff automation technology. I would like to say that we have been quite successful so far: We support Indian machinery manufacturers with our technology so that they can produce high-quality products that can stand their own ground on the world market. Meanwhile, it can be said that PC-based automation is widely accepted in various industrial sectors. Many customers are also convinced by the fact that the PC control system is an optimal platform for mastering the challenges of connected production facilities in terms of IoT and Industrie 4.0. We have grown steadily from the outset, and with our innovative technologies and an excellently qualified team, we are fulfilling all prerequisites for future growth: India has enormous potential and the corresponding framework conditions provided by the Indian government optimally support the country’s economic development. We will take advantage of this and systematically expand our sales network by opening new locations.

Further information: www.beckhoff.co.in
Hudson Scenic Studio sets the stage for show applications of all sizes with scalable control technology from Beckhoff

**Blockbuster effects, automated for any theatrical production**

In William Shakespeare’s celebrated play, “As You Like It”, the legendary playwright famously wrote that “all the world’s a stage, and all the men and women, players”. Perhaps this kinship to the theater experienced by audiences is what continues to drive the success of plays around the world. Making the storytelling and action seems effortless, enabling the viewer to naturally step into the lives of the characters on stage, takes a herculean effort behind the scenes. This is where Yonkers, NY-based Hudson Scenic Studio comes into play, providing scene fabrication and automation services to the entertainment industry since 1980.
Chuck Adomanis, Senior Engineer at Hudson Scenic Studio, explains: “Over the years, we have built a solid reputation as a full-service theatrical automation and production shop. Our extensive experience in the entertainment industry provides us with the ability to offer custom artwork and stage pieces, scenic construction and automation for nearly any stage or show application. We serve the Broadway theater market and provide solutions for other live events, TV and film, and for permanent installations such as theme parks and cruise ships.”

Flexible and scalable control technology for projects of any size and budget

Hudson Scenic Studio serves some of the largest and most successful Broadway shows to ever hit the stage. Their impressive repertoire include productions such as Disney’s “Aladdin”, and “Hamilton”, the smash hit musical about the life of American founding father Alexander Hamilton. However, Hudson Scenic offers support for stage and show technology to customers of all sizes, as Adomanis continues: “I think the biggest differentiator for Hudson Scenic is flexibility and our willingness to work with any customer, big or small, to help them discover the best solution for their needs. Whether the production is a multimillion dollar Broadway show or a play at a small regional theater, we have the flexibility to tailor systems and components that ideally fit the client’s application.”

Hudson provides the means for creative directors and their crews to bring their boldest stage and show ideas to life. From the ground up, the company offers planning services, project management, fabrication and commissioning to help nearly any stage and show application earn rave reviews. To accomplish this, Hudson builds incredibly intricate scenery and stage props, and then makes that scenery dynamically move, shift and change to enhance the visual direction of the show. In the Aladdin project, for example, buildings that form the marketplace of Agrabah move and rotate across the stage while turrets raise and lower. Every individual action, or effect, such as opening a trap door in the stage floor, lifting a section of scenery or helping an actor fly across the stage, requires complex control technology. There are virtually no limits to the imagination here; however, the prerequisite for staging such blockbuster effects is that the mechanical systems, the software and the automation work smoothly.

A peek behind the curtain

Behind the scenes, large control cabinets house the automation and control systems for the show. The HMI software developed by Hudson is used to operate the whole system. Controlling all the complex moving parts in a large-scale theatrical production such as the Broadway shows served by Hudson requires a robust control system in the background. Specifically, Hudson uses Beckhoff CX2030 Embedded PCs with 1.5 GHz Intel® Core™ i7 dual-core CPU, as well as several CX5100 Embedded PCs with Intel® Atom™ processors. Hudson also uses 7-inch CP6606 Panel PCs with ARM Cortex™-A8 processors for testing effects before implementing them in the field. Chuck Adomanis explains the need for a variety of controllers: "Each of these devices acts as a primary system controller, running PLC, NC and HMI software as the main control devices in our automation system. The highly scalable range of
controllers allows us to choose the right performance level for the job, and it helps mitigate cost for the shows and for customers.” When larger screens are required, the Hudson-programmed HMI is displayed on a series of 15-inch Beckhoff CP2916 multi-touch Control Panels.

TwinCAT 3 automation software provides the core underlying architecture for Hudson control systems. Adomanis continues: “We use a variety of TwinCAT 3 packages for PLC and motion control, given the varied nature of our projects, and we utilize the full range of available TwinCAT modules: TwinCAT PLC and NC for axis control, TwinCAT ADS, TwinCAT TCP/IP Server or TwinCAT OPC UA for horizontal and vertical communication. TwinCAT gives us remote access to show sites, ensuring that our customers receive timely service from our experts.” Remote access enables Hudson to diagnose equipment issues anywhere in the world without engineering teams having to physically travel to the venues, providing significant cost savings which can be passed on to the customer.

Control-integrated safety solution meets complex requirements
As one can imagine, safety is paramount for stage and show applications. Hudson Scenic relies heavily on the TwinSAFE system from Beckhoff to integrate the wide range of necessary safety functions into the automation system, such as guard doors and e-stops. “Our previous e-stop solution was hard-wired to run a 24-volt signal, which required running additional cable,” explains automation engineer Erik Nelson. “With TwinSAFE, we have a single cable and it connects everything, greatly simplifying our commissioning, increasing reliability, and allowing us to satisfy increasingly complex safety requirements.”

Flexible, cost-effective and reliable: the high-speed EtherCAT system
Communication of the real-time relevant signals in the field takes place via EtherCAT. EtherCAT Terminals and EtherCAT Box Modules offer best-in-class speed, as well as a minimal footprint – essential in the space-constrained applications Hudson takes on every day. In addition, the low cost of the Beckhoff I/O terminals was especially appealing for Hudson Scenic, as Chuck Adomanis explains: “The EtherCAT I/O system offers a low price per point and with TwinCAT, we can quickly map and freely configure I/O, adding up to significant cost savings.”

Beckhoff servo drive technology implemented as the standard
For motion tasks, Hudson relies on AX5000 series EtherCAT servo drives and AM8000 series synchronous servomotors from Beckhoff, a change from the three-phase induction motor systems used in the past. Beckhoff servo drive technology is now used as the standard motion system. “As the technical demands of our projects continue to grow and change, One Cable Technology (OCT) for the motors and drives, when coupled with absolute encoder technology, provides excellent value in our projects and will be our standard on new equipment,” Adomanis said.

Increased performance and profitability earn critical acclaim
Beyond added flexibility in system design and maintenance, Hudson Scenic achieved impressive performance increases. Adomanis explains: “With our
previous PLC and motion system, we were living in a world with scan times higher than 20 milliseconds for PLC commands and motion control. Now, our scan times are around 1 or 2 milliseconds, which could certainly be decreased further if necessary. When working with EtherCAT and TwinCAT, we can accomplish real-time, microsecond-level deterministic I/O communication, which was impossible in the past."

In addition, engineering costs have been greatly decreased while efficiency has increased. “Code written for one project is easily scaled from one effect to another without a lot of rework,” said Erik Nelson. “We’re no longer stuck manually addressing data registers and PLC memory.” Adomanis also noted that though the specific cost savings are not easy to quantify, “we can say unequivocally that our margins have dramatically improved on projects and Hudson can go after applications large and small with PC-based control and EtherCAT technology and maintain high profitability.”

“Beckhoff is able to go beyond the ‘basic automation and controls’ vendor with entertainment industry-specific technologies, such as I/O terminals with DMX communication and other standards used for lighting and multimedia equipment,” Adomanis noted. “Working with an automation company like Beckhoff, with profound understanding of entertainment applications, provides considerable benefits to Hudson Scenic Studio and our clients.”

As these projects grow in scope and technological complexity, the Hudson Scenic Studio team is ready to meet any entertainment engineering challenge that comes their way. With Beckhoff providing the controls foundation, these talented engineers have the necessary tools to keep bringing the artistic visions and dreams of stage and show professionals into reality.

Further information:
www.hudsonscenic.com
www.beckhoffautomation.com
EtherCAT servo drive technology precisely synchronizes motion sequences

Nedschroef’s metal forming machines were previously powered by a single motor. A complex mechanical system with gear units and camshafts allowed all functions of the machine, including the gripper finger that transports the products between the individual machining steps, in order to run synchronously. “The gripper carriage was the first component that we equipped with separate servo drives,” explains Ivo Van Gorp, Coordinator/Developer Automation at Nedschroef. “In the past, the cams themselves had to be moved in order to adapt the machine when changing production, which was not only time-consuming but also limited the setting range. After equipping each gripper and carriage with its own servomotor, all positioning limitations have been removed.”
to. An additional advantage is that the opening and closing of the dies is no longer coupled to the finger drive. To grip very short products, the fingers have to move at much higher speeds than the speed at which the products are pushed out of the die. This wasn’t possible before,” says Matheeussen.

More flexibility through faster changeovers

“Our customers were initially reluctant to use the mechatronic solution because they were used to working with purely mechanical systems. In order to simplify the transition to electronic control, we presented some parameters on the HMI in the same way as in the previous cam control system. The creation of an intuitive interface has made the transition much easier. Once you are familiar with the new technology, you can quickly see the advantages. Many of our customers have to change over their machines several times a day. This is now much faster and the error rate has been significantly reduced,” explains Van Gorp.

Nedschroef now also uses servo drive technology for material feed, and a Beckhoff linear motor handles the rod feed. The complete machine control runs on a C6930 Industrial PC, which integrates both PLC and drive control. “The NC tasks are also implemented in software modules,” adds Van Weert. “This makes it easy to adapt all profiles for motion synchronization.”

However, the transition from a mechanical gear unit to a servo drive system presented Nedschroef with challenges. “Our fastest machines produce 240 screws per minute,” says Van Gorp. “That means four strokes per second. For each stroke, one-third of the time can be used to grip and advance the screws. The gripping itself must take place within one-twelfth of a stroke. It was not easy to find a drive system that could react so quickly and build up sufficient gripping force in such a short time.” Nedschroef finally found the solution in the AM8000 series servomotors and AX5000 Servo Drives from Beckhoff. “Servo technology has numerous advantages. With this solution, all cam-setting restrictions have been solved. The adjustment of the gripping force of the fingers, which used to be mechanical, is now also done in software. In addition, we receive feedback from the servo drives. If a finger has gripping a product incorrectly or incompletely, this is detected immediately and can be responded.

“Motion synchronization is now performed in TwinCAT software from Beckhoff,” says Nedschroef Programmer Tom Van Weert. “We use an EtherCAT network with a cycle time of 500 μs. This allows us to precisely synchronize the various machine movements with those of the dies.” The mechanical cam controller has been completely replaced by TwinCAT NC Camming, which enables faster, safer and error-free changeovers while providing more setting options. The parameters are stored for each product in the controller and can be adapted or retrieved from the graphical user interface, which helps even less experienced machine operators successfully handle rapid changeovers.

About Nedschroef Machinery

Nedschroef Machinery is a leading supplier of multi-stage machines for cold and hot forming of metals. Founded in 1961, Nedschroef Machinery is now part of Nedschroef Holding. The company is headquartered in Herentals, Belgium.

Further information:

www.nedschroef.com
www.beckhoff.be
The Icelandic company Valka, headquartered in Kópavogur, specializes in the development of automation solutions for the fish industry and has made a name for itself with technological innovations in this market, which is characterized by demanding production requirements. The system developed by Valka produces extremely precise cuts at different angles through a combination of X-ray radiation, 3D image processing and a robot-controlled water-jet cutting head. Fully automatic deboning, filleting and portioning of fresh fish are accomplished quickly, reliably and efficiently, giving Valka’s customers key competitive advantages.

Valka has specialized in the development of automation solutions for the fish industry since the company was founded in 2003. Among other solutions, the company has introduced systems for fish cutting, deboning, weighing, packaging and ice dosage onto the market.

“In the past we worked with different technologies and suppliers, which made the variety of interfaces increasingly difficult to handle. That’s why we decided to fundamentally revise our automation infrastructure by choosing the open PC- and EtherCAT-based platform from Beckhoff as the universal controller,” says Valka’s Marketing Manager Ágúst Sigurðarson, describing the initial challenge that arose two years ago. “Today, we can say we made the right decision,” adds Einar Björn Jónsson, Product Development Manager at Valka. “Instead of special components from various suppliers we now use standard components from Beckhoff and get everything from a single system: the PC-based control platform integrates all necessary functions, from the PLC and the robot axes through to the safety systems and the HMI. The effort required for the manufacturing, calibration and troubleshooting of our machines has been reduced significantly on account of the centralized control platform.”

The control platform of the cutting machines consists of a C6920 control cabinet Industrial PC (IPC) with Intel® i7 quad-core processor and TwinCAT 3 automation software. All four processor cores are utilized in order to exploit...
the full performance of the IPC: the operating system and the motion control technology each use one core, while the PLC uses two cores. On the networking side, compact EtherCAT I/O modules are used for the I/O connections. Safety technology is also integrated seamlessly into the control system via EtherCAT safety I/O modules. The motions of the cutting robot are controlled in software via TwinCAT NC I and TwinCAT Kinematic Transformation, while AX5203 EtherCAT Servo Drives and servomotors from the AM8000 series with One Cable Technology are used as the drive technology.

The Valka cutter removes bones and cuts the fish into precise portions fully automatically. “We developed a combination of X-ray radiation, 3D image processing and robot-controlled water-jet cutting heads that makes it possible to identify even very fine bones down to a width of 0.2 mm. The robots can work at different cutting angles and cut the bones out with such high accuracy that we now have losses of only 4 percent compared to 6 percent previously. For our customers that means additional revenues of several million kroner per year, depending on the tonnage of fish processed,” Einar Björn Jónsson stresses. Each fish fillet is analyzed precisely and cut into even portions with regard to size, weight and thickness according to the respective specification.

In addition, different cutting patterns or programs can be defined in the software and various fillet sizes can be determined flexibly.

“A key special feature of these robotic solutions is that they are operated with a standard software platform – entirely in keeping with the philosophy of Beckhoff that all software tools must function on a simply structured platform,” says Einar Björn Jónsson.

Iceland and Norway are among Valka’s most important sales markets: “With our faster and more intelligent production solutions we are also increasingly gaining market share in the rest of Europe and in the United States. That’s an exciting development, and this progress is all backed by reliable technological support from Beckhoff,” concludes Ágúst Sigurbjörnsson.
XTS transport system at the core of a smart factory concept

Assembly solution 4.0: for more efficiency in production down to lot sizes of 1

The “Flexim Open Automation System” combines modularity, flexibility, reconfigurability and connectivity to meet the requirements of small production lots right down to individualized production. Developed by Italian start-up company “Smart Factory”, the system consists of a basic machine module that can be extended as required with standard or customer-specific production modules and flexibly adapted to individual applications. At the core of the solution is the XTS linear transport system with the PC-based automation architecture from Beckhoff.

New, frequently changing packaging designs and the trend towards individualized marketing campaigns present companies with several challenges: smaller and smaller lots have to be produced, and increasingly frequent production changes have to be carried out quickly and efficiently. The provision of fast machines alone is not enough to achieve all this; what is also required is an automation system that offers integrated connectivity and maximum flexibility for reconfiguration.

Smart Factory, a new reality based in Northern Italy, focused on this challenge to develop a breakthrough solution with Beckhoff at its core. It is called Flexim Open Automation System, an automation solution fully reflecting Industrie 4.0 paradigms. The modular design of the system enables the flexible production of packaging solutions for different markets: the machine base can host up to 10 modules for various operations such as pressing, gluing, rolling, bolting, cutting, knurling, electromagnetic forming, ultrasonic welding, printing, quality control; any station can be connected to the basic module to perform a wide range of manufacturing processes. The system is very easy to reconfigure: the operator can connect, switch and swap modules on the machine base in just a few simple steps, thanks to a plug-and-play capability achieved by hardware and software-based configuration. In addition to the standard system modules, it is also possible to integrate customer-specific processing stations, which the company develops on demand, or to integrate a Smart Factory enabled XTS system onto a larger scale production line.
operating systems and devices such as smartphones and tablets. The integration of an augmented reality device from Microsoft can also be used for various purposes, such as context-related search for machine documentation, employee training, troubleshooting and remote maintenance services.

Using TwinCAT IoT products, the Flexim system can exchange process data via standardized communication protocols and access special data and communication services offered by cloud service providers such as Microsoft Azure™. In this way, production-relevant information such as quantities, defects or machine downtime and process parameters including temperature, pressure, consumption etc. can all be conveniently evaluated and analyzed. In this way, detailed statistical analyses can be carried out and preventive maintenance guidelines can be defined to increase the system availability through process-related assignment of operating variables.

The modular XTS system and PC-based automation architecture from Beckhoff not only facilitate excellence in terms of dynamics and precision, they also provide the required modularity and flexibility for the Flexim Open Automation System. “By being able to use an integrated development environment, TwinCAT 3 enabled us to optimize the various design phases and achieve excellent results. Last but not least we benefited from the competent and continuously available technical support offered by Beckhoff Italy,” said Andrea Pozzi.

The XTS eXtended Transport System from Beckhoff is the centerpiece of the Flexim solution. It can be linked to a wide range different processing modules in order to implement varying assembly or machining processes. “The modular concept offers a number of advantages. The key benefit is the reduction in lead time,” explains Andrea Pozzi, who heads the research, development and design department at Smart Factory. “Another advantage is the fact that our basic machine had to be developed only once and can be adapted to different applications simply by connecting it with the various processing modules. The flexible control architecture of the PC platform is the basis for the easy configuration and reconfiguration of the system.”

The XTS transport system consists of modular linear motors with integrated power electronics and position feedback, cable-free movers and a mechanical guide rail; it therefore is a perfect match to the modular approach of the Flexim solution. “In our opinion, the XTS is a key technology enabler,” confirms Andrea Pozzi. In contrast to a classic rotary dial and index system, where all machining stations are subjected to a basic machine cycle and the complete system has to be synchronized with the cycle time of the slowest station, the XTS can be used to determine exactly how many parts per cycle are to be processed independently of each other in each station. That is, the slowest processing step will simply be carried out twice by two stations, without impeding the operation of the other stations. Since individual motion commands can be assigned to the movers, all processing steps can be controlled individually and independently of each other. “The XTS makes it very easy to set up an assembly station, for example. No mechanical operations such as positioning of reference plugs or indexing are required. Each mover reaches the programmed position with very high dynamics and accuracy,” adds Andrea Pozzi.

**Integrated PC-based control architecture scores through openness**

Beckhoff supplied the entire automation platform for the Flexim project, including the C6930-0050 Industrial PC, digital and analog I/Os, safety and measurement terminals, AX5000 Servo Drives and AM8000 series of servomotors with One Cable Technology. “Our decision to use the XTS was a fundamental one,” explains Andrea Pozzi. “The open and modular control architecture from Beckhoff offered us vital advantages at all levels in terms of hardware, software and communication.”

“For example, the use of TwinCAT 3 has enabled us to develop C# applications in a Microsoft Visual Studio® environment, which is a platform we are very familiar with,” continued Andrea Pozzi. “Moreover, EtherCAT also offers great advantages in terms of speed and flexibility.” For example, we were able to use EtherCAT to control the synchronicity during the operating cycle of a magnetic forming device. The cycle, which is characterized by a current discharge with very high intensity (about 100 kA), only lasts around one hundred microseconds. In this way, caps with potentially very complex shapes can be produced, which enhance cosmetics packaging with a high-quality appearance.

**TwinCAT IoT solution increases system availability**

The Flexim system meets all the typical requirements of Industrie 4.0: it offers full connectivity and is equipped with an innovative HMI solution that can be used with Beckhoff multi-touch Control Panels, but also supports all resolutions,
Suruga Seiki is a medium-sized company that produces industrial machinery such as e.g. precision positioners and opto-mechanical devices. The company has already been successfully using Beckhoff control technology for a number of years in its fully automatic positioning tables, which are used for high-precision alignment of smartphones during testing of touchscreen displays, for example. To explain why the company committed to its smart factory initiative, Mr. Takeshi Marui, Suruga Seiki president, says: "We produce up to 300,000 different products in small quantities − down to lot sizes of one. We sell mainly through online marketplaces, distinguishing ourselves from our competitors by guaranteeing delivery within three days of order receipt. In order to be able to meet these extremely short production and delivery times, even at times of high incoming orders, we decided to optimize our production and introduce a flexible production system based on a data distribution network that connects all processes and facilities.”

Therefore, in 2015, the company launched its smart factory initiative, which uses a cyber-physical system (CPS). "Moving forward with a CPS required us to standardize our existing production system beforehand and get underway with optimization activities in terms of efficiency, precision and system reliability," Takeshi Marui explains.

Digital data network connects processes and production sites

The first step to realize a smart factory was to digitize the information required in each process and integrate this information − from design to production. By taking advantage of the experience and skills already acquired through such activities, the company proceeded to establish data connectivity across all processes. According to Mr. Marui, the policy regarding this task was to build a system-integrated holistic platform in which all digital data is centrally managed to ensure seamless data exchange between the design, production and shipping.

Efficient production down to lot size one and short delivery times

Industrie 4.0 finds its way into production of precision positioners

Interest in smart factories and related initiatives is increasing in all industrial markets worldwide. The Japanese manufacturing industry is also following the trend of digitalization, but so far lacks the implementation of actual solutions as opposed to concept studies. Suruga Seiki Co., Ltd., manufacturer of precision instruments based in Shizuoka, Japan, has taken the step towards digital networking of its production and expects competitive advantages in the market as a result.
processes in a timely manner. However, while it was possible to more quickly communicate production information to each process in this way, it only had limited effect on making the production processes more efficient. Therefore, Suruga Seiki developed a system to automatically generate the data required for production (CAD, machining data, assembly data, etc.) based on the customer specifications, which are directly integrated into the data management system as production parameters. Through this end-to-end automation of the production management process from product specifications through to machine operation parameters, Suruga Seiki successfully made major improvements to the entire production process.

Implementation of the Industrie 4.0 concept
To implement its smart factory Suruga Seiki used the Industrie 4.0 concept for digitization in manufacturing, a strategy which was defined in Germany, and the corresponding RAMI4.0 reference architecture model. Because Industrie 4.0 covers all business processes, not only the production process, the company is making the most of such concepts for system development, and complements it with its own functions: By applying a so-called “Administration Shell” to the data, the company can produce the same product in identical quality on machines from different manufacturers and from different generations and specifications. The Administration Shell serves as an abstraction layer and compensates for the variability of the machines by automatically adapting the processing profiles for the respective machine: For this reason, each processing machine is equipped with a CX5140 Embedded PC from Beckhoff including integrated Administration Shell functionality. The machining program is generated automatically and sends appropriate instructions to the various machines, resulting in optimal processing. Another improvement is that Suruga Seiki can now centrally manage the production data for all machines via one of the most powerful industrial controllers in the world, a Beckhoff C6670 many-core control cabinet IPC.

A particular challenge was the integration of the company’s considerable in-house expertise, which bundles the entire knowledge and experience of the company. Suruga Seiki was especially keen to implement quality inspection of the workpieces and to generate optimal machining parameters based on artificial intelligence (AI). The finished product is now subjected to an intensive quality control procedure, and the process is continuously optimized through feedback sent to the machine.

PC-based platform excels in openness and expandability
“For the digitization of our production we have received comprehensive technical consultation and support from Beckhoff,” says Takeshi Marui. Suruga Seiki installed a kind of test factory called “Suruga CPS Lab” for testing the feasibility of networking and data acquisition methods, and for optimizing the processes. “The modular structure of the Beckhoff I/O system enables the easy installation of new I/O components without significant programming burden,” explains Naohito Fukazawa. “This was extremely effective for test verification and also for future expansion considerations. One important reason we chose Beckhoff as a solution provider was the open control platform – it enables us to use our assets, such as existing machines and applications. The fact that TwinCAT control software is Windows-based is another advantage.” Particularly against the background of the convergence of automation and information technology as associated with Industrie 4.0, Windows provides a powerful, flexible and future-proof platform.

Smart factory concept enhances competitiveness
Suruga Seiki implemented digital networking at its production facilities in Japan, China and Vietnam and uses it to visualize each process of each machine in each factory. Moreover, the company has developed a system to make the machining programs used on equipment in Japan available at factories independently of their location. This enables identical products of equivalent quality to be flexibly machined at other facilities.

Suruga Seiki’s sales grows by more than 30% percent annually. Takeshi Marui attributes this success to the introduction of the smart factory concept and the integration of the latest technologies such as artificial intelligence (AI) and augmented reality (AR). Regarding future objectives of the company, Mr. Marui sums up: “As a ‘Mittelstand’ company in Japan, I believe in demonstrating the ability of mid-sized companies to compete globally. To this end, I believe that continuing to adopt new technologies will be vital moving forward.”
The EtherCAT Technology Group (ETG) has supplemented EtherCAT with Time Sensitive Networking (TSN) technologies, expanding the field of possible EtherCAT applications to include heterogeneous network environments. With the help of TSN, industrial controls can contact a number of different EtherCAT segments in real-time through Ethernet networks. In doing so, no changes to the EtherCAT slave devices are required: the EtherCAT Device Protocol, including all high performance characteristics, is fully preserved. Also expanded by TSN is the EtherCAT Automation Protocol (EAP) for communication between controls, which will result in even more deterministic performance on this level.

Dr. Guido Beckmann, Chairman of the ETG Technical Committee classifies the new specification as such: “The incorporation of TSN standards will significantly improve the real-time characteristics of generic Ethernet. With our technology expansion we make use of TSN in an ideal way – and exactly where TSN can offer significant advantages: in the factory networks. As one frame is sufficient for EtherCAT to communicate with a whole segment, and thus with the entire fieldbus network, EtherCAT is virtually predestined for integration with TSN networks. We achieve this without turning our technology inside out. EtherCAT together with TSN offers the ‘best of both worlds’. Therefore, this prepares EtherCAT perfectly for the future.”

A Whitepaper on the subject, written by Dr. Karl Weber, has been published in November 2017 and is available on the official ETG website.
ETG celebrates 10 years in the US, China and South Korea

Three out of the five EtherCAT Technology Group (ETG) offices recently celebrated their 10th anniversary. In 2007 the ETG, with global headquarters in Nuremberg, Germany, had just reached the milestone of 500 member companies and decided to expand the organization’s international presence. The ETG office in Yokohama, Japan had already been founded in 2006. The next step was to open up offices in the US, China and South Korea in order to best support the local ETG member companies.

The ETG China office is located in Beijing and is still led by Beryl Fan, who coordinated the opening of the office. Upon the founding of this office in 2007, the ETG had 10 members in China – in 2016 they welcomed their 500th member company. Today the ETG counts almost 800 members in China and Taiwan.

Other important milestones in the development of EtherCAT in China include the 2013 accreditation of Beihang University as an official EtherCAT Conformance Test Center (ETC) and the acceptance of EtherCAT as a Chinese national standard in 2014. Today EtherCAT is considered the most popular fieldbus for drive technology in China.

In late 2007 an ETG South Korea office opened in Seoul, managed by Key Yoo. EtherCAT has made great gains in the Korean semiconductor industry, automotive, consumer electronics manufacturing and other key industries such as shipbuilding and robotics. Moreover, the leading local control system manufacturers have made EtherCAT their standard system fieldbus.

The ETG office in North America is led by Bob Trask. The US office also takes care of members from Canada and Latin America. The ETG has more than 600 members in the Americas, making it the largest fieldbus organization also there.

The ETG is in a prime position at the international level. More than half of the currently 4,600 member companies are headquartered outside of Europe. More than a third hail from Asia, which is the fastest-growing region in the EtherCAT community.
Trade shows 2018

Europe

Germany
Automotive Testing Expo
05 – 07 June 2018
Stuttgart
www.testing-expo.com/europe/en

Achema
11 – 15 June 2018
Frankfurt am Main
www.achema.de/en

Automatica
19 – 22 June 2018
Munich
www.automatica-munich.com

Sensor+Test
26 – 28 June 2018
Nuremberg
www.sensor-test.de

SMM
04 – 07 September 2018
Hamburg
www.smm-hamburg.com/en

Meorga
12 September 2018
Ludwigshafen
www.meorga.de

AMB
18 – 22 September 2018
Stuttgart
www.messe-stuttgart.de/amb/en

FachPack
25 – 27 September 2018
Nuremberg
www.fachpack.de/en

WindEnergy Hamburg
25 – 28 September 2018
Hamburg
www.windenergyhamburg.com/en/

Motek
08 – 11 October 2018
Stuttgart
www.motek-messe.de/en

Meorga
10 October 2018
Bochum
www.meorga.de

EuroBLECH
23 – 26 October 2018
Hanover

FMB
07 – 09 November 2018
Bad Salzuflen
www.forum-maschinenbau.com

SPS IPC Drives
27 – 29 November 2018
Nuremberg
www.mesago.de/en/SPS

Austria
Smart Automation
15 – 17 May 2018
Vienna
www.smart-wien.at/en

France
Enova Toulouse
30 – 31 May 2018
Toulouse
www.enova-event.com

Sepem Industries
05 – 07 June 2018
Colmar
www.sepem-industries.com

All4Pack
26 – 29 November 2018
Villepinte
www.all4pack.com

Great Britain
Manufacturing & Engineering North East
04 – 05 July 2018
Newcastle
www.menortheast.co.uk

Italy
SPS IPC Drives Italia
22 – 24 May 2018
Parma
www.spisitalia.it

IPACK-IMA
29 May – 01 June 2018
Milan
www.ipackima.com/en

Switzerland
EPHJ-EPMT-SMT
12 – 15 June 2018
Geneva
www.epjh.ch/en

Sindex
28 – 30 August 2018
Bern
www.sindex.ch/en

Finland
Pohjois Teollisuus
23 – 24 May 2018
Oulu
www.northernindustry.fi

PacTec
29 – 31 May 2018
Helsinki
www.pacptec.messukeskus.com

Wood
29 – 31 May 2018
Helsinki
www.woodexpo.messukeskus.com

FinnBuild
10 – 12 October 2018
Helsinki
www.finnbuild.fi

Energia
23 – 25 October 2018
Tampere
www.energia-messut.fi

Smart Factory
20 – 22 November 2018
Jyväskylä
www.smart-factory.fi

Norway
Eliaden
29 – 31 May 2018
Oslo
www.eliaiden.no

ONS
27 – 30 August 2018
Stavanger
www.ons.no

Spain
Hispack
08 – 11 May 2018
Barcelona
www.hispack.com

BIMEH
28 May – 01 June 2018
Bilbao
www.biemh.com/en

Matelec
13 – 16 November 2018
Madrid
www.ifema/matelec_01/
### Sweden
Elmia Automation  
15 – 18 May 2018  
Jönköping  
www.elmia.se/en/automation

Scanautomatic  
09 – 11 October 2018  
Gothenburg  
www.scanautomatic.se

### Turkey
Robot Yatırımları Zirve ve Sergisi  
16 – 18 October 2018  
Istanbul  
www.robotyatirimlari.com/en

### Africa
South Africa  
Electra Mining Africa  
10 – 14 September 2018  
Johannesburg  
www.electramining.co.za

### Asia
China  
ChinaPlas  
24 – 27 April 2018  
Shanghai  
www.chinaplasoline.com

IAMD Beijing  
09 – 11 May 2018  
Beijing  
www.iamdbj.org/EN/  
AHTE  
03 – 06 September 2018  
Shanghai  
www.epchinashow.com

India  
ACMEE  
21 – 25 June 2018  
Chennai  
www.acmee.in

Automation Expo  
29 August – 01 September 2018  
Mumbai  
wwwutomationindiaexpo.com

Israel  
New-Tech Exhibition  
29 – 30 May 2018  
Tel Aviv  
www.new-techevents.com/new-tech-exhibition

Thailand  
Manufacturing Expo  
20 – 23 June 2018  
Bangkok  
www.manufacturing-expo.com

### United Arab Emirates
Wetex  
23 – 25 October 2018  
Abu Dhabi  
www.wetex.ae

Adipec  
12 – 15 November 2018  
Abu Dhabi  
www.adipec.com

### North America
Canada  
Montreal Manufacturing Technology Show  
14 – 16 May 2018  
Montreal, QC  
www.mmsts.ca

FabTech Canada  
12 – 14 June 2018  
Toronto, ON  
www.fabtechcanada.com

ATX Montreal  
14 – 15 November 2018  
Montreal, QC  
www.atxmontreal.com

USA  
Offshore Technology Conference  
30 April – 03 May 2018  
Houston, TX  
http://2018.otcnet.org

Windpower Expo  
07 – 10 May 2018  
Chicago, IL  
www.windpowereexpo.org

National Plastics Expo  
07 – 11 May 2018  
Orlando, FL  
www.npe.org

### InfoComm
06 – 08 June 2018  
Las Vegas, NV  
www.infocommshow.org

ATX East  
12 – 14 June 2018  
New York, NY  
www.atxeast.com

Industrial Automation North America  
10 – 15 September 2018  
Chicago, IL  
www.hannovermesseusa.com/trade-shows/iamd-usa

Pack Expo International  
14 – 17 October 2018  
Chicago, IL  
www.packexpointernational.com

FABTECH  
06 – 08 November 2018  
Atlanta, GA  
www.fabtechexpo.com

### South America
Brazil  
Fispal Tecnologia  
26 – 29 June 2018  
São Paulo  
www.fispaltecnologia.com.br/en

Further information:  
www.beckhoff.com/trade_shows