



The Japanese company Suruga Seiki offers a comprehensive range of high-precision positioning devices.

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.

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

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.



Example application of a precision positioner: the CX5140 Embedded PC helps achieve a synchronization accuracy of $\pm 1.0 \mu\text{m}$ with four-axis synchronization control.



(from right to left) Naohito Fukazawa, General Manager of Stage Division at Suruga Seiki, Takeshi Marui, Suruga Seiki President, Toshimitsu Kawano, Managing Director of Beckhoff Automation K.K. and Akimitsu Kumagawa, application engineer at Beckhoff

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."

Further information:

www.surugaseiki.com

www.beckhoff.co.jp