TECHNICAL ARTICLE

Bosch Rexroth delivers a complete approach to semiconductor solutions with the expert support, trusted performance and custom, cross-technology subassemblies tool builders and design engineers need to stay agile and competitive.

Accelerating Semiconductor Automation Engineering with Custom Subassemblies

The race to expand semiconductor production and support our ever-growing digital world is creating enormous opportunities, and challenges, for the industry. While billions of dollars are being invested to expand and build semiconductor fabs, the time it takes to get new production up and running continues to be a major hurdle for chip manufacturers. That's because chips are beginning to push against the limits of Moore's Law. With ever smaller transistors more densely packed onto integrated circuits, the accuracy and precision required of chip manufacturing equipment make design and engineering extremely complex.

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For tool builders in the semiconductor industry, intense competition and demand for new manufacturing technologies means they need to design, engineer and build solutions as rapidly as possible while also meeting the most challenging technical requirements. With the demanding time constraints and complexity of semiconductor manufacturing systems, design engineers are increasingly turning to experts like Bosch Rexroth to design and manufacture custom mechatronic subassemblies for complete, ready-to-install wafer handling robots. This allows semiconductor equipment engineers to focus their energy on their core competencies and the advanced tools needed for lithography, etch and other critical processes in chip fabrication.

Through smart, well-engineered linear motion components, motors, controls and sensors, mechatronic systems from Bosch Rexroth provide complete solutions that are easier to integrate and deploy.

Mechatronic subassemblies play an integral role in accelerating time to market for new tools while meeting the difficult demands of the semiconductor industry. Through smart, well-engineered linear motion components, motors, controls and sensors, mechatronic systems provide complete solutions that are easier to integrate and deploy. Bosch Rexroth is uniquely positioned to meet the demanding performance, quality and reliability requirements of mechatronic subassemblies in chip manufacturing. For decades we have been investing in an industry-leading portfolio of both linear motion and motion control products, focusing on the needs of some of the most cutting-edge automation machine builders and end users in the semiconductor industry.

Bosch Rexroth's strength in mechatronics goes beyond our core motion products, which have been proven in thousands of installed systems worldwide. We combine those products with advanced mechatronic expertise and experience in semiconductor applications. This includes deep insights into the principles and design requirements for sizing, selecting and integrating the right kinds of linear motion equipment — linear guides, ball screw drives and linear systems — with extensive experience specifying and programming complete motion control systems for wafer processing applications.

A COMPLETE APPROACH TO SUBASSEMBLIES

At Bosch Rexroth, successful and efficient subassembly development means taking a holistic view for design. For example, with an understanding of how mechanical elements affect the motors and controls, we can avoid problems down the road. If a design is based around a specific motor without first considering the mechanics, larger mechanical components may be required to handle the motor torque or inertia. This can result in an over-engineered solution, when a smaller motor and smaller mechanical components could have been used.

That is why cross-technology subassemblies like wafer lifts and wafer stages developed by Bosch Rexroth are sized and integrated to achieve an inertia ratio that is ideal for the application dynamics and precision. Our expansive portfolio also makes it easier for us to develop these integrated electromechanical solutions, because we manufacture virtually all the core system components.

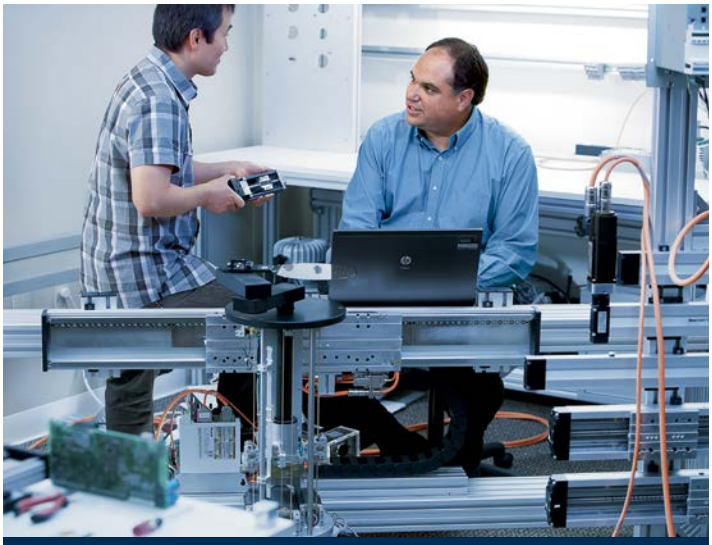
Some companies seeking to provide these kinds of integrated, complete mechatronics have to source key components, such as motors, drives or linear systems, from multiple suppliers. That can lead to risk factors if the third-party suppliers don't have experience in the unique requirements for semiconductor tools. For example, if the lubrication used in the ball screws is not cleanroom certified, the lubricants could release contaminants that can ruin wafers, costing tens of thousands of dollars.

Working with an expert provider who understands and supports best practices, such as copy-exact, with a complete solutions portfolio will also give manufacturers more

flexibility when changes are needed. For example, a wafer transport tool may over time need some modifications due to new motion control requirements or the need to substitute a part due to supply chain issues. As a custom subassembly manufacturer with full control over its manufacturing and supply chain, Bosch Rexroth has the resources and expertise to design, test, document and validate any modification to a design so that the tool builder can install the updated version with full confidence in its performance.

A FULL-SERVICE PARTNER FOR DESIGN, ENGINEERING AND LIFECYCLE SUPPORT

The complexities that lie at the heart of today's advanced transistor features create enormous challenges for tool builders, but they don't have to face those challenges alone. Our motion control experts have completed countless custom engineering projects and can help fill critical knowledge gaps to bring subassemblies online efficiently and effectively. Using a concurrent engineering approach, we work closely with customers to spec, design, test and rapidly deploy solutions that improve performance and profitability.



Our highly responsive semiconductor team collaborates closely with customers to provide everything from specs to product samples to prototypes, helping customers design and deploy their tools faster and more efficiently.

In one case study, a tool designer and end-user manufacturer wanted to achieve smoother motion when moving delicate wafers between two process points. Bosch Rexroth developed a fully integrated wafer lift assembly combining compact servo drives, motors, controller and ball screws to fit within the wafer processing tool envelope with an efficient, space-saving design. The end result was a custom assembly that achieved highly reliable performance, exceeding the customer's target of five million cycles while providing a 30 percent cost reduction versus a version the tool builder was trying to design and develop in-house.

When it comes to solving problems, Bosch Rexroth takes a proactive approach to meet today's challenges while keeping ahead of new and changing industry needs. Our team of engineers and service professionals collaborates with customers to evaluate new requirements, anticipate new demand and recommend integrated solutions to future-proof operations. Our highly responsive semiconductor team can provide everything from specs to product samples to prototypes, helping customers design and deploy their tools faster and more efficiently.

Our robust service infrastructure and comprehensive portfolio are intrinsically tied together to provide greater value and quality to our customers. That's how we've successfully built strong, multi-decade relationships with leading semiconductor tool builders and fab operators, providing a range of automation solutions engineered to meet the most demanding requirements.

As the semiconductor industry continues to evolve at a breakneck pace, Bosch Rexroth is ready to deliver the expert support, trusted performance and custom, cross-technology subassemblies tool builders and design engineers need to stay agile and competitive. With the most complete automation portfolio, proven mechatronic subassembly expertise and full lifecycle service and support, we can help semiconductor equipment manufacturers improve quality, efficiency and reliability to move the semiconductor industry forward faster.

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