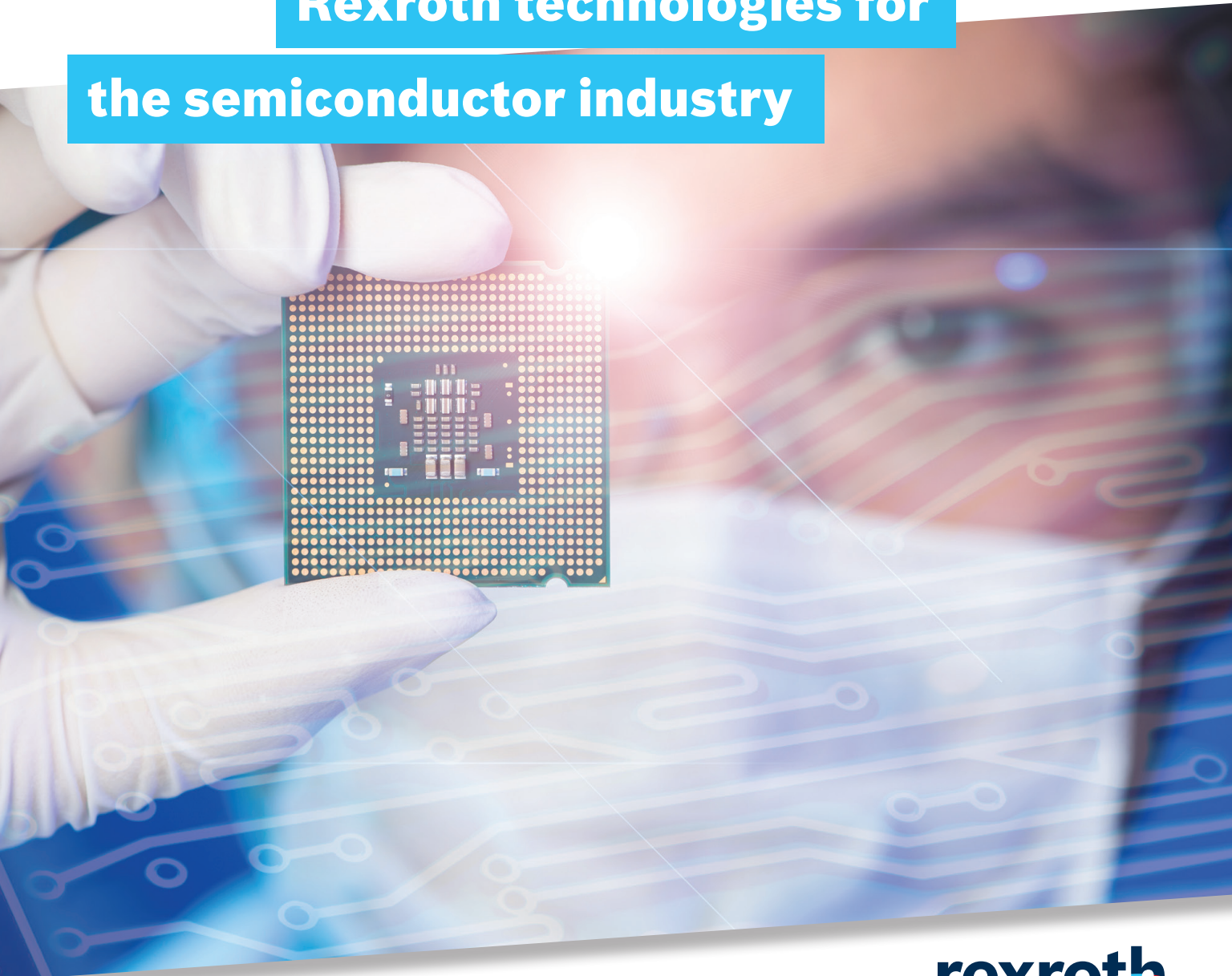


# Rexroth technologies for the semiconductor industry



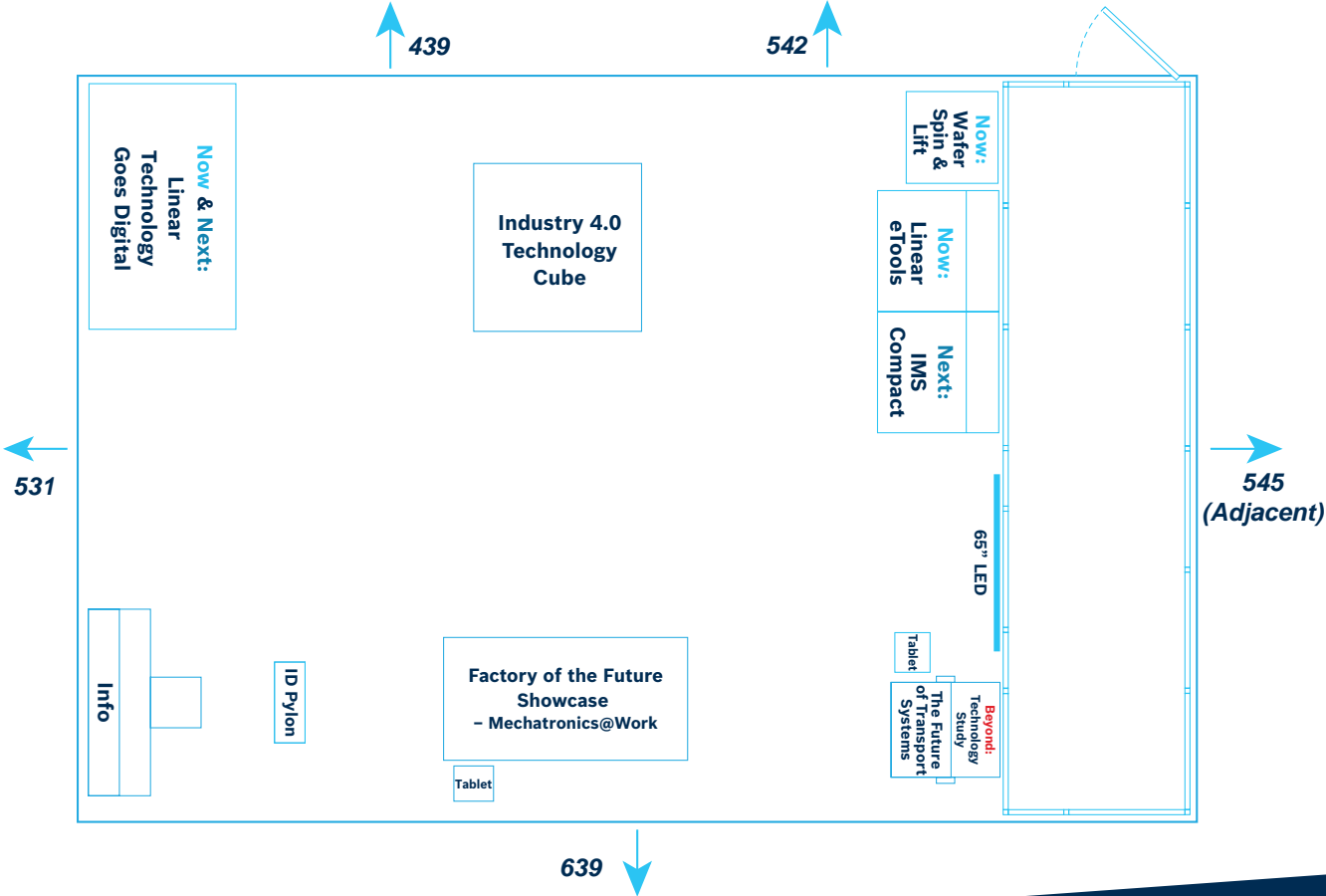


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# Bosch Rexroth brings the Factory of the Future to SEMICON West 2019, Booth #539!

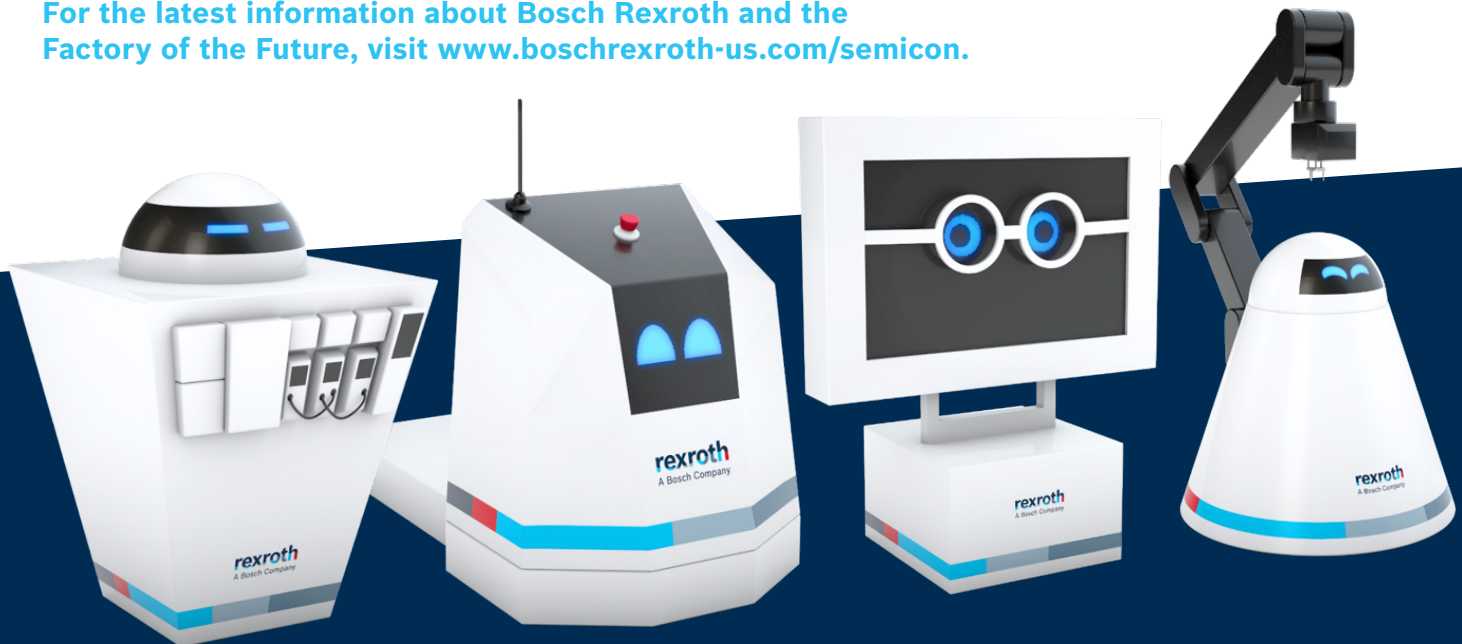
Discover how Rexroth's innovative technology helps bring advanced Factory of the Future and Industry 4.0 concepts to life for the semiconductor industry.

Stay competitive in today's rapidly changing semiconductor manufacturing market with high-precision automation technology for every segment of the microelectronics supply chain—from laboratory automation to wafer fabrication to final device packaging. With our latest advanced automation technologies and Industry 4.0 solutions, we can help you get from Lab to Fab faster than ever.

We're presenting multiple exhibits and interactive demonstrations from our technology portfolio to help improve semiconductor manufacturing yields. These include advanced motion control platforms and high-performance linear motion systems that are currently available, plus previews of new products slated for launch in the near future, along with an opportunity to experience future cutting-edge systems such as a maglev-based wafer transport system.

Experience advances in automation control, mechatronics, linear motion and Industry 4.0 technology for wafer handling and other semiconductor manufacturing processes through this informational booth brochure. In addition, Rexroth semiconductor manufacturing experts will be available to discuss solutions for key issues such as wafer transport, motion control and automation to help improve performance and yield as the semiconductor industry continues to evaluate technology for future node development. **Bosch Rexroth – Now, Next, Beyond!**

**For the latest information about Bosch Rexroth and the Factory of the Future, visit [www.boschrexroth-us.com/semicon](http://www.boschrexroth-us.com/semicon).**





## Now: Factory of the Future Showcase, featuring Mechatronics@Work

Mechatronics@Work from Rexroth combines high-performance mechanical technologies and motion control systems with open, user-friendly programming environments to create the most accessible, easy-to-use Cartesian motion robots.

### How it relates to i4.0

- Rexroth Motors, Drives, and Controls enable monitoring of system and individual axes performance while showing how custom orders are produced inside a factory at the machine level
- Collects and displays machine and production data from various software platforms to produce custom product batches

### Benefits

- Flexible integration of Rexroth's linear motion, assembly, and automation solutions
- Easy connection to the internet using the IoT Gateway Rack

### Applications

- Machine data collection through various sensors and IoT-ready products
- Cloud-based software to collect, analyze and display machine and production data





## Now & Next: Digitalization of Linear Technology (LT)

The Digitalization of Linear Technology shows products and digital solutions to optimize processes and predict wear sooner and more accurately than ever before. Witness virtual digital support throughout the entire product life cycle, from engineering, commissioning and preventive maintenance to technical service. Get a glimpse of Rexroth's technological leadership of Linear Motion Technology for the Factory of the Future – what is already possible **now** and what will be possible in the **next** few years!

### How it relates to i4.0

- New products and solutions will be available along the whole process chain, from configuration, ordering and commissioning, to operation, diagnostics and maintenance
- Software tools, online services, intelligent systems and integrated sensors required in the Factory of the Future provide maximum productivity and shorter time-to-market

### Benefits

- Simplified product selection and sizing with online tools
- Automated ordering and delivery process
- All the system data will be available, so you'll benefit from a plug-and-play commissioning process, without having to input data or correct source errors
- Operation: Machine data in real time enables permanent process optimization
- Service and predictive maintenance for maximum availability

### Applications

- Semiconductor manufacturing

## Now: Integrated Measuring Systems – IMS-A, IMS-I

Rexroth's IMS systems are linear encoders that are integrated into Ball or Roller Rail Systems to provide exact linear positioning feedback for precise tool or workpiece positioning. Available in both Absolute (IMS-A) and Incremental (-I) versions, IMS saves hours of maintenance and calibration time compared to glass scale systems. It is simply the easiest linear encoder to design in, install, and use.

### How it relates to i4.0

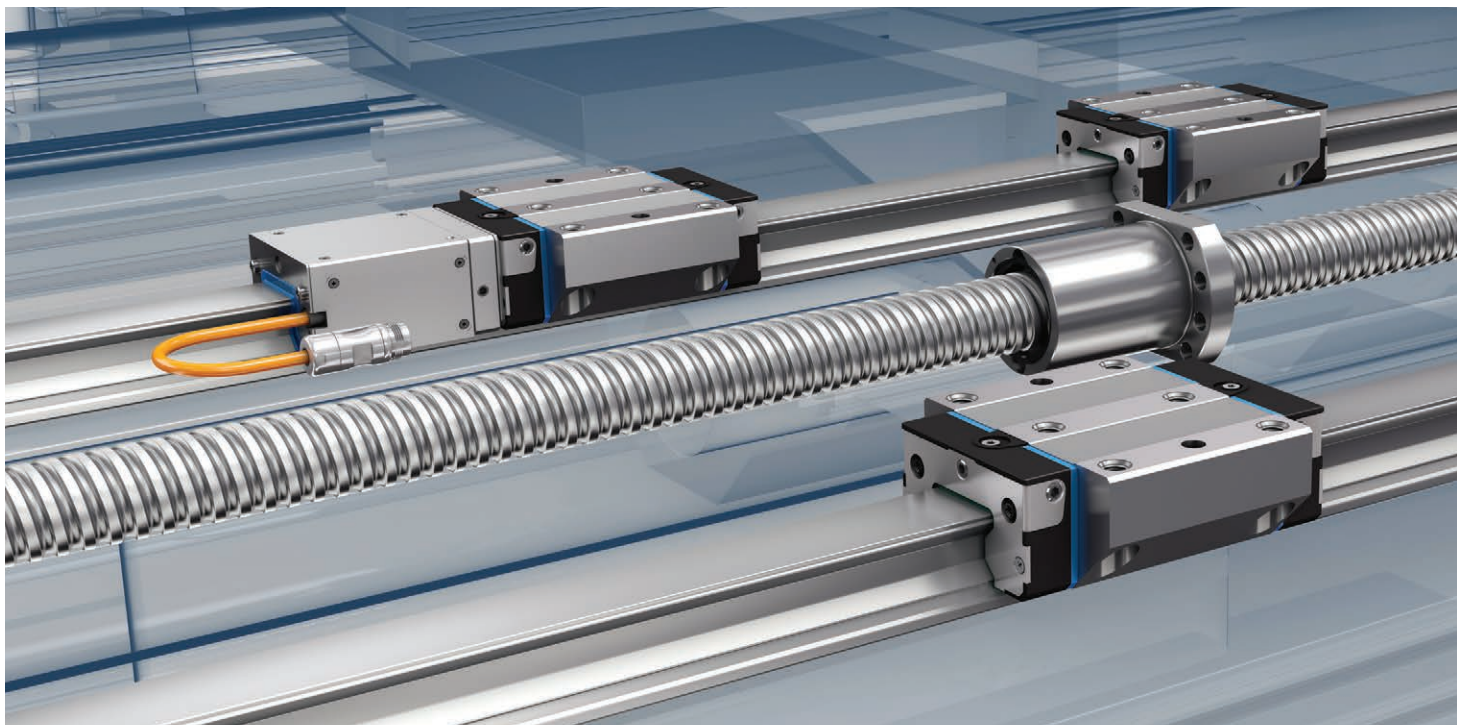
- Precise position monitoring and control in real time allows for predictive maintenance and improved machine efficiency
- Easily paired with Rexroth and other third party drives and controls

### Benefits

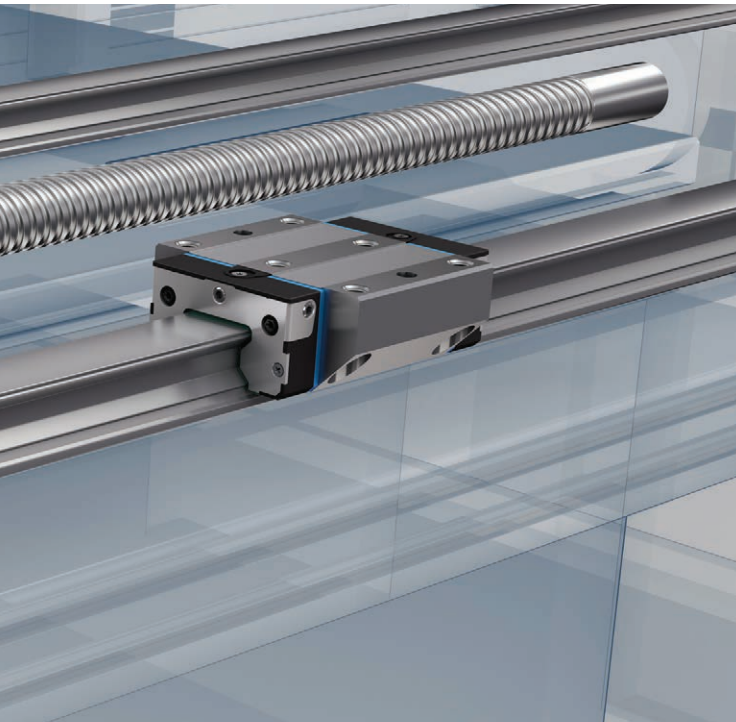
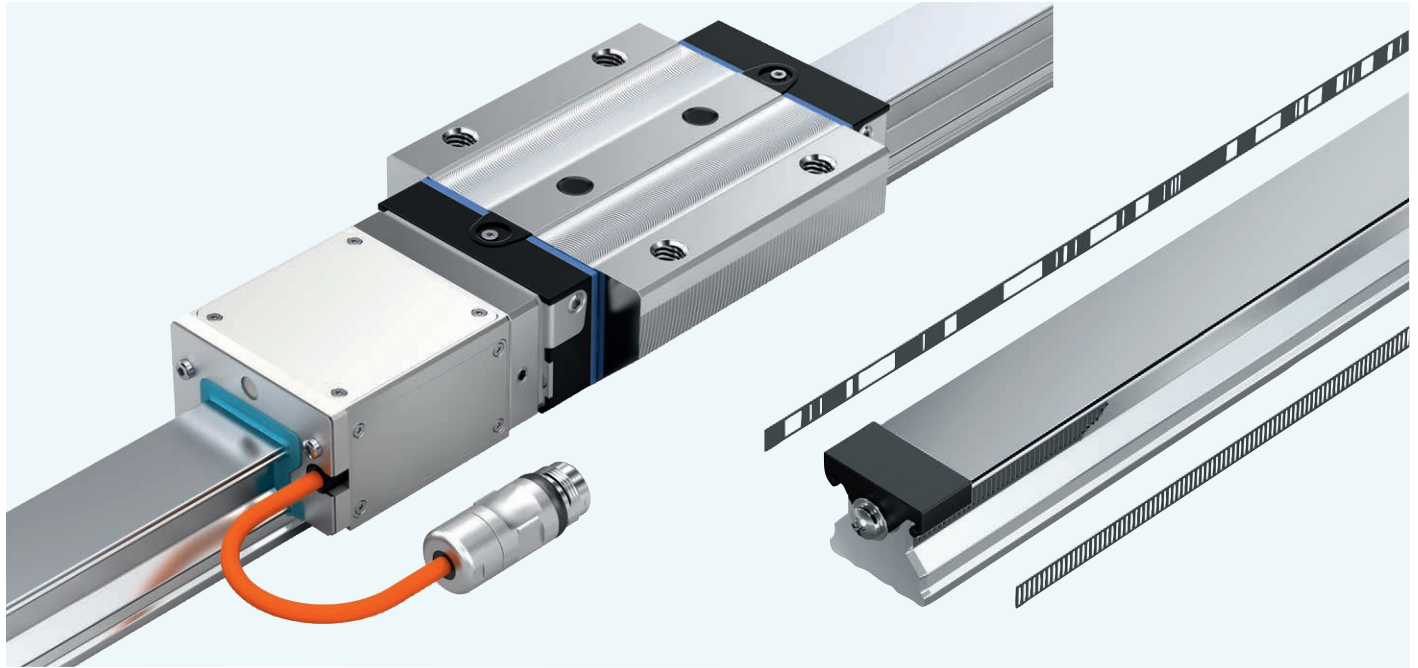
- Time savings: IMS eliminates installation and tuning of an external scale
- Space requirements: Smaller footprint means smaller machines; users get more productivity in the same floor space
- Less maintenance downtime, lower total operating costs (TOC): Low-wear, contamination-resistant, easy to replace
- Reliable performance improves safety

### Applications

- Additive manufacturing, large format 3D printers, digital printing and printed electronic machines
- Linear-motor-driven systems requiring very accurate positioning







## Next: IMS Compact coming in 2020

The IMS Compact, the latest addition to the Rexroth family of integrated measuring systems for linear motion, combines a highly rigid Rexroth ball rail and roller rail system with a non-contact length measuring system. The IMS Compact integrates the sensor read head into the rail system runner block to save space and provide a more compact configuration for tight profiles.

### Benefits

- Economical solution
- New size 15 with completely integrated encoder
- Simple assembly and commissioning
- IoT capable by Edge Device, for quality and process monitoring

### Applications

- Designed for automation and handling tasks



WE

MOVE

YOU

WIN

## Beyond: The Future of Transport Systems Technology Study

Bosch Rexroth is currently conducting a study on an innovative transport and handling system. The technology based on magnetic levitation has exceptional qualities that could revolutionize the factory of the future. Components can be transported gently, quietly and smoothly on carriers with six degrees of freedom and 360° endless rotation at a variable height of up to 20 mm—without any heat generation on the surface. A truly non-contact motion solution.

**This innovative transfer and handling system could offer the factory of the future these benefits:**

- Contactless motion technology
- Dynamic path adaption during operation
- Easy system planning through integrated simulation
- Variable carrier size, shape and payload

- Reduction of cycle times and required space by flexible movement to stations
- Enables combination of transfer technology and process functionality
- Magnetic levitation, no abrasion or mechanical wear, safe operation
- Absolutely clean
- Reduction of downtimes and maintenance-free operation

### Future Applications

- Vacuum wafer transport in Semiconductor Manufacturing
- General purpose transport
- Pharma liquid transport





## Engineered to meet customer requirements

### Now: Wafer Spin and Lift

The wafer spin and lift demonstration shows how Rexroth integrates high-speed spindle performance and vertical lift into one complete mechatronic assembly. Solutions are built upon standard components, in collaboration with the customer and Rexroth's automation experts.

Utilizing an MBT spindle motor, readily-available ball guides and ball screws, IndraDrive Cs for control, and an MSM servo motor for lift, this unit demonstrates how working with Rexroth provides for a seamless customer interface. The integration and manufacturing capabilities of multiple technologies, along with collaborative engineering, mean we move, you win.

#### Examples of critical requirements

- Vibration performance
- Environment (vacuum, high temperature, corrosive)

- Packaging (limited or constrained tool real estate)
- Positional accuracy
- Motion smoothness
- Rigidity
- Operating life

#### Benefits

- Simplify final assembly
- Simplify supply chain and supplier management
- Simplify quality control
- Reduce inventory and simplify service

#### Applications

- Customized solution based on unique specification

## Now: Industry 4.0 Technologies Cube

The I4.0 cube is divided into four sections to showcase Rexroth Connection Solutions and IoT software. Live data from the Mechatronics demo will be shown using Bosch IoT Cloud as well as Microsoft Azure.

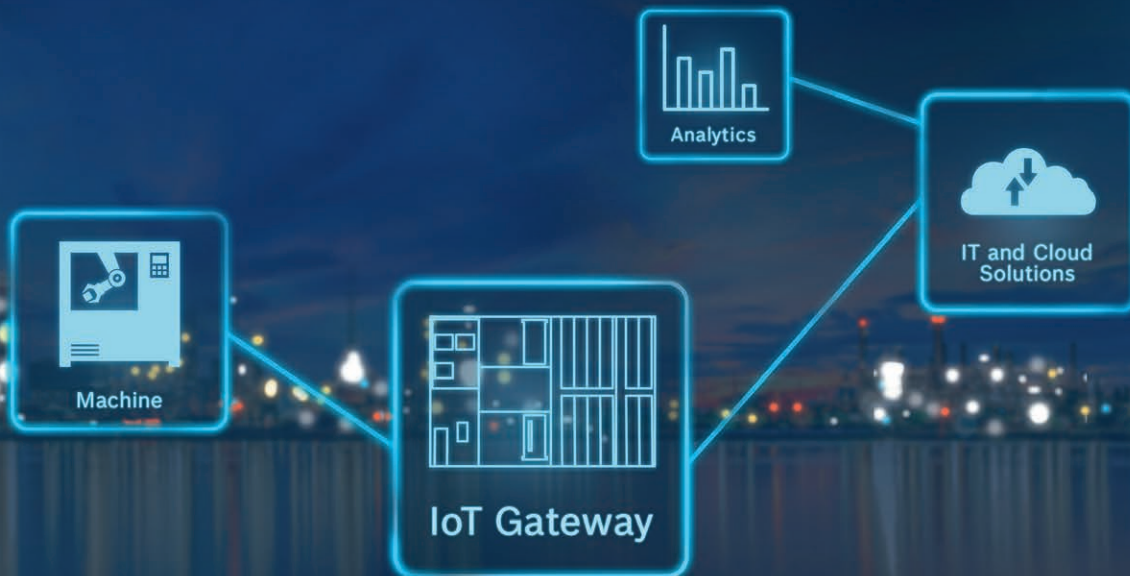
**IoT Gateway Rack** is an IP65-rated enclosure containing Rexroth's award-winning IoT Gateway. It includes all the necessary wiring and connections to connect I/O, sensors, PCs and other data sources for collection, processing and forwarding of plant floor data to upper-level data systems or local servers as part of our solution for i4.0 Automation.

It connects with the Rexroth designed **IoT Insights** software solution, which addresses a market need for simple dashboard-based local analytics, visualization and remote alert algorithms for immediate notification. IoT Insights and IoT Gateway rack offer a complete i4.0 solution to various industries including Semiconductors.

For example, these solutions help to optimize a fab line for chip performance and high production throughput. With

huge streams of data coming from each individual fab tool it is important to manage the data in a simple but effective way. IoT insights software in combination with IoT Gateway offer Semiconductor OEMs and end users alike a quick and efficient entry into the Connected Automation realm.

In addition, Bosch offers unique sensing products like **CiSS, Connected Industrial Sensor Solution**, that help to increase Overall Equipment Efficiency (OEE) by monitoring, in real-time, automation processes, overall machine health and environmental conditions like humidity, temperature and vibration on the specific fab tool. Sensors are easily integrated in the IoT Gateway Rack, adding another innovative product in Rexroth's i4.0 solutions portfolio.





**IndraDrive CS drive** – versatile and flexible intelligent servo drive platform to be deployed in variety of applications from 3A to 54A of peak current.

Integrated-in-the-drive WebServer allows remote monitoring via standard web browsers, with real-time Multi-Ethernet protocols support including standard TCP/IP telegram.

### Benefits

- Ethernet-based communications, multi-protocol support: EtherCat, Sercos III, PROFINET IO, EtherNet/IP
- Innovative multi-encoder interface: Hiperface®, EnDat 2.1, 1Vss, 5 V TTL, and MSM, MSK and MS2N servo motors

- Energy efficient product – DC bus sharing
- Digital inputs/outputs and analog input on-board
- Optional IC61131 based PLC on-board
- Integrated Motion Safety

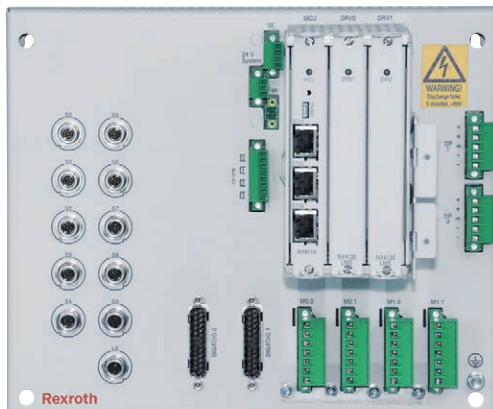
### Applications

- Majority of servo motion applications

**Servo Motors** – Rexroth offers a wide range of servomotors in their portfolio including synchronous and asynchronous rotary motors, synchronous linear and kit motors, where the motors become an integrated part of the machine – significantly improving dynamic performance by eliminating mechanical transmissions in a form of gears, pulleys and couplings.

In the semiconductor world it means better velocity control for wafer handling applications, faster and more precise positioning tasks allowing the movement of high inertia loads without any parasitic oscillations.

Intelligent housed rotary motors offer many innovative solutions as well that benefit every industry including semi-conductors. For example, the motor encoder can store application data for fast parameters recovery to minimize machine down time. Enhanced field weakening mode allows a much larger torque-speed range: the result is a physically smaller motor for high speed, high torque applications.



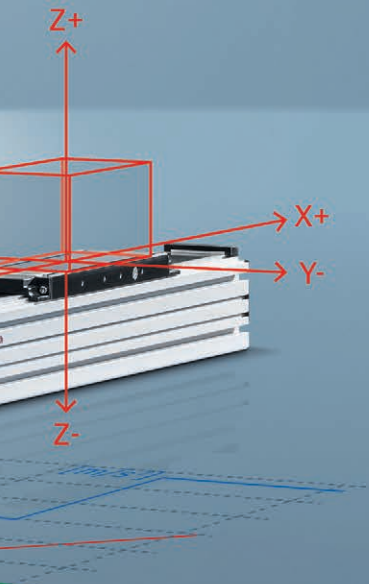
**IndraControl YM** – The precision motion control system IndraControl YM allows an unprecedented level of design freedom. Its next generation hardware is designed to handle complex operations, which together with the open software architecture enables the creation of tailored motion solutions that can be simply integrated into your automation landscape. The extremely compact modular multi-axis controller houses all the control and drive hardware, offering a great benefit for smaller control cabinets in semiconductor machine automation.

Semiconductor market users benefit from pre-defined software algorithms that ensure zero-vibration and zero-backlash in demanding wafer handling motion applications.

Customized kinematics, fast processing tasks and high speed control loops offer a complete freedom in machine design in high precision applications including metrology, semiconductor processing, medical and many more.







## Now: Linear Motion eTools

Linear Motion Technology by Rexroth supports you with modern eTools for product selection, configuration, and ordering, for a shorter time-to-market. The **Linear Motion Designer (LMD)** is the calculation program for Rexroth's Profiled Rail Systems and screw assemblies. It covers the complete range of roller and ball rail systems as well as Ball and Planetary Screw Assemblies. A modern interface with extended help and safety functions simplifies operation and quickly leads to optimum results.

**LinSelect** software allows design engineers to find the optimal linear axes and actuators from around 100,000 possible Rexroth product variants in just five steps. The new selection tool completes the digital workflow from product selection right through to ordering in the Rexroth eShop. Here, selecting complete axes and actuators extends beyond the mechanicals— it also encompasses suitable Rexroth motors and drive controllers. A full range of **Configurators** assist with suitable product solutions.

### How it relates to i4.0

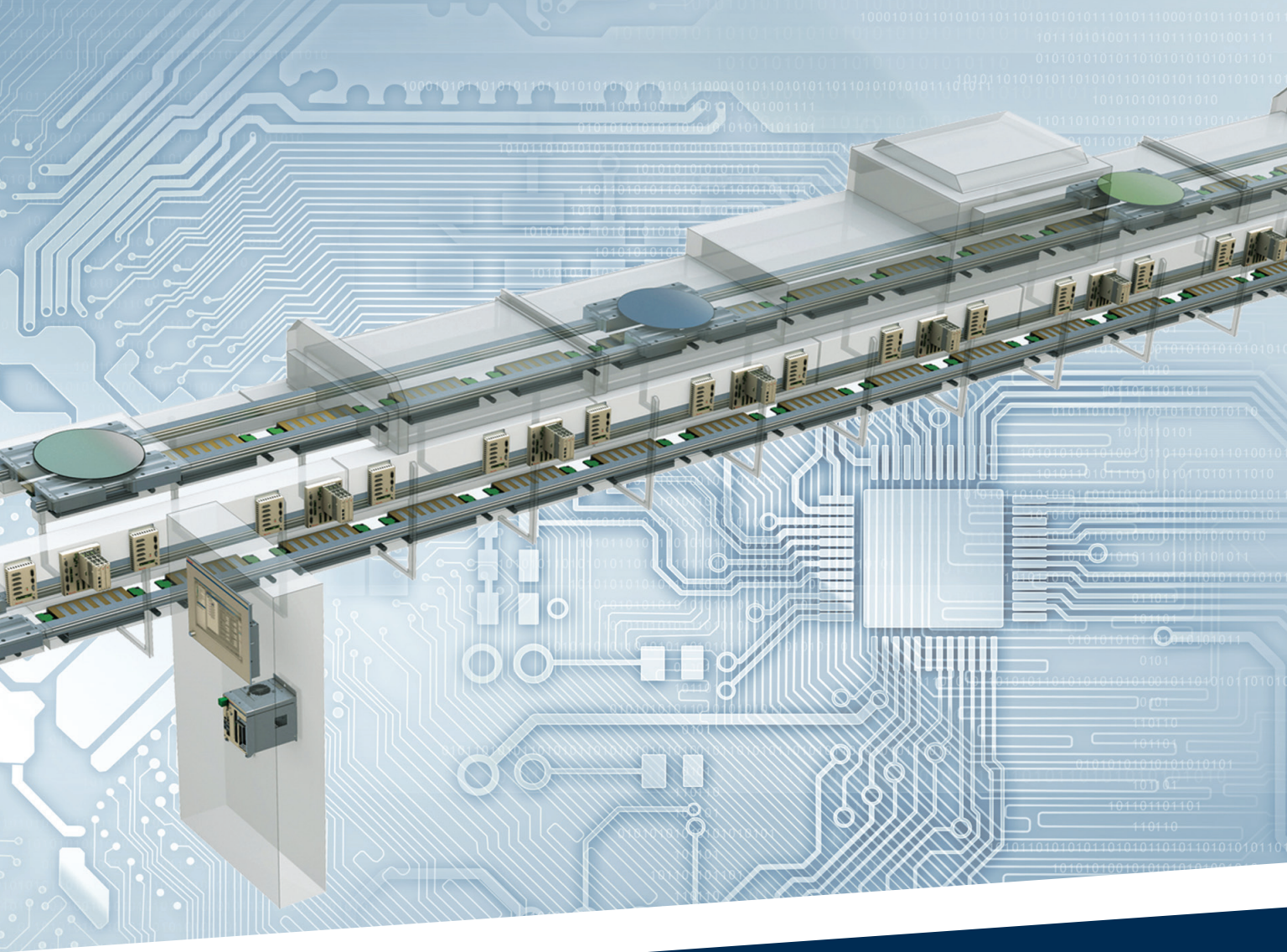
- Design tools shorten the design and product selection phase via an intelligent product filter that calculates application parameters via intelligent algorithms to identify the right product fitting application

### Benefits

- Includes application input guidance and builds in design safeguards to consider so that the user will not undersize the application
- Provides full report and detailed analysis for project and/or machine folder to be referenced for the life of the machine
- Easily transfers the optimum product variant into an online configurator with a mouse click to obtain CAD Models in a variety of formats

### Applications

- Semiconductor manufacturing
- Component-based or pre-engineered linear axes



# Factory of the Future

Now. Next. Beyond.



## Now: Flexible Transport System (FTS)

In-line process automation is an alternate concept for the manufacturing of Semiconductors and Displays. It reduces machine and facility costs, simplifies the logistics in the fab and improves the production yield. With solutions using our YM and XM series advanced controls, systems can be connected vertically and horizontally via open standards and easily deliver relevant information in real-time.

Our award-winning Flexible Transport System (FTS) is a linear motor based transport system that provides a contactless and particle-free solution for the positioning of materials and work pieces inside or between machines. The system works both in and out of vacuum and cables do not tether the carriage.

Simplified and able to perform under the most challenging conditions, the Rexroth flexible transport system FTS integrates an external non-contact motion system.

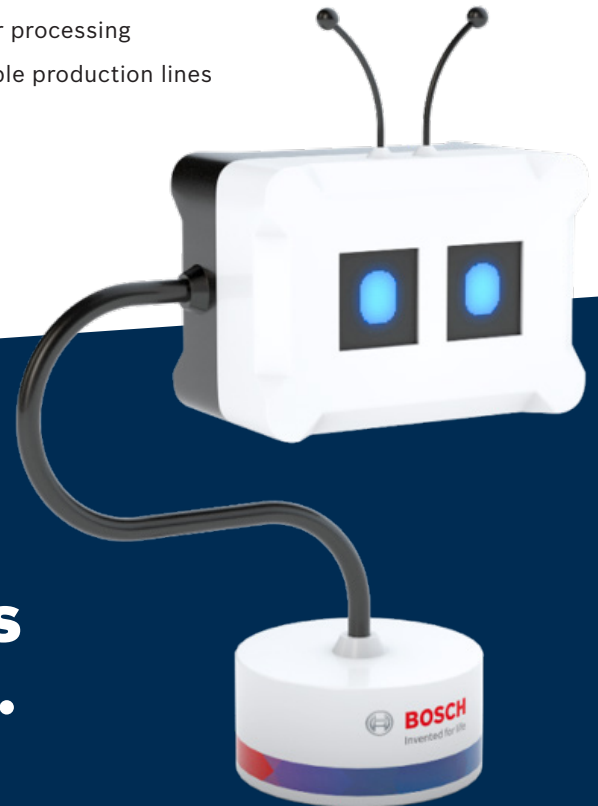
Coils mounted outside the chamber provide drive power for magnetic carriers that don't require seals. The external mounting also increases availability. This linear motion technology is suited for virtually all load factors, precision levels and motion profiles. The system allows exceptional flexibility and enables individual carriers to move forwards and backwards at varying speeds.

### Benefits

- Extreme positioning accuracy and high repeatability
- Individually scalable - adapts to every size requirement
- Flexible and adaptable
- Easy to integrate
- Intelligent motion control
- Optimized diagnostics

### Applications

- In-line manufacturing
- Semiconductor manufacturing
- Photo-voltaic solar cells or thin film
- Optical components
- Wafer processing
- Flexible production lines



**Thank You** for visiting us  
**at SEMICON West 2019.**

USCOR00161/06.2019

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