Automation meets IT: Industry 4.0 – welcome to a new reality

After three exciting industrial revolutions, we now have the fourth – the consistent networking of machines, people and processes. In Industry 4.0, the real world of machines is being linked to the virtual world of the Internet and IT. The Bosch Group has a leading role in the world as a supplier and user. Already today, this knowledge is contained in Bosch Rexroth’s products and at the Drive & Control Academy in unique training solutions. Welcome to Education 4.0!
The fourth industrial revolution
Three industrial revolutions brought along great changes – the steam engine, mass production and information technology. Now automation and IT are getting connected. In Industry 4.0, a single value-added network is arising from individual value chains. Beyond company boundaries. Comprehensive networking opens up completely new opportunities in manufacturing, for example the efficient production of smallest-sized series and individualized products.

Industry 4.0 is already a reality at Bosch Rexroth
The Bosch Group is not only a leading supplier in industry 4.0 – as the foremost provider of products and systems, we are also a key user. More than 50 Industry 4.0 pilot projects are currently going on in 270 Bosch plants worldwide. We’re putting this expertise to use in the Drive & Control Academy.

Bosch Rexroth benefits from being both a supplier and a user, as do our clients, from the full force of our synergies. Our practical experiences in manufacturing simultaneously flow into our customer solutions and into our training concepts. We can therefore promote Industry 4.0 in small, quick steps worldwide.

Leading provider and user: profit from Bosch’s expertise, take advantage of synergies
Even today you can find a variety of practical applications at Bosch Rexroth with immense potential to make manufacturing more flexible and efficient. From complete cabinet-free drive technology to condition monitoring fully-networked hydraulic standard power units. And we already offer the appropriate training programs for many parts of Industry 4.0. Only those who understand the individual parts and how they are networked with one another are able to help support the big picture.
An overview of Industry 4.0: a complex topic, many facets, simple answers

**Total networking – horizontal and vertical**
The new dimension of processes in Industry 4.0 is most evident if you imagine the degree of networking when it comes to collaboration. The linking of all value creation processes (ordering, delivery, production, logistics, service) across company and country boundaries. Horizontally and vertically. From the supplier to the customer. From the Excel list in the accounting department to the individual RFID-tagged product part.

The pathways and processes for a permanent exchange of data must be organized and controlled. Across all hardware and software interfaces. So suddenly SAP communicates with the PLC. Without an integrated technology that enables barrier-free networking between automation and IT, the decentralized component documentation necessary for Industry 4.0 will not work. Clearly, without open standards, nothing is going to work.

**Logistics from RFID, PLC to SAP**
If a component is going to determine how it would like to be produced in the future, then the logistics must be controlled from the RFID data entry all the way to the ERP and MES systems. Object-related data controls not only individual process and editing steps, but also, for example, the type or variant-specific feeding in and ejection of workpiece pallets in distributed systems.

**All in full view: ActiveCockpit**
Industry 4.0 means quick communication and quick decisions. Only with a central, interactive platform, such as the ActiveCockpit from Rexroth you always have all the latest data you need at your fingertips – for clear decisions, based on real-time status information, sent directly from a team meeting to the appropriate places. This has proven to bring 30% more efficiency into processes.

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**The value stream network**

- **Horizontal networking**
  - Management & planning
  - Customers
  - Plant 2
  - External designers

- **People as a key player**
  - The requirements for Industry 4.0 at a glance. These facets need to be mastered:
The basis: Open Core Engineering
The Hermes award-winning Open Core Engineering (OCE) from Rexroth connects the until now separate worlds of PLC and IT: with open standards, software tools, function packages and the open core interface as an allround interface. This bridge combines classic IEC engineering with the new possibilities of high-level language programming. A completely new level of freedom and efficiency.

The goal: the Smart Factory
Fully self-controlling manufacturing is still a vision. The Smart Factory demonstrator from Bosch Rexroth already shows Industry 4.0 with its distributed intelligence, open communication and simple programming languages at work. It was designed according to specifications of the German Research Center for Artificial Intelligence (DFKI). You can better understand and learn these practical facets of Industry 4.0 with the mMS4.0 training system.

Ideas and solutions for Industry 4.0 on the Internet:
www.boschrexroth.com/industry-4-0

The smart factory demonstrator in a video:
www.youtube.com/watch?v=X7ZDeVsBDbY
A whole factory in miniature: understand and learn Industry 4.0 with the mMS4.0 training system

Cyber-physical system

Functional adaptations to the manufacturing process are made via smart devices, data capturing and fault diagnostics in real time. Solutions can be simulated and then seamlessly implemented into the production line – without physical adjustments.

Connectivity

PLC control units can communicate with almost any programs and other participants via the all-round Open Core interface. For example, for controlling a 6 axis robot with the Rexroth PLC.

New configuration in production

Thanks to vertical data flow the operating times are maximized. Newly-configured data, such as parts lists, are transferred to each level in the corporate structure. The MES-system monitors and controls.

Cloud engineering

Cloud platforms collect and store process data. The cloud provides engineering data whenever a module is accessed. With mMS 4.0, for example, maintenance instructions or the stock status can be sent all over the world via the cloud.
The mMS 4.0 training system – a complete Industry 4.0 system in miniature. The system addresses a real-life cube assembly, from the removal out of a rack to processing with a pressing machine and through to storage in the high-bay storage. Assembled from standard components, completely interconnected, programmable and extensively secured. Cells can be flexibly added to the system, such as with a 6 axis robot. The entire system or individual stations are shipped fully assembled, installed, and programmed. You can get started right away.

**Interactive communication platform**

In Industry 4.0, digital boards, such as the ActiveCockpit, collect, filter, and visually depict data continuously in order to indicate possible improvements and problems. This happens in real time, so that downtime is minimized and productivity increased.

**Smart workstations**

The operators are detected, and there is an automatic adaptation of the workplace preferences, such as language or workplace height. In addition, there is simple and individually adaptable worker guidance in real time.

**RFID in production**

Industry 4.0 products carry an RFID tag that tells each manufacturing station precisely what is to be done – decentralized and autonomously. This includes, for instance, data for documentation, material or quality control. The data is then accessed via a smart device.

**Drive & Control Academy:**

Discover training, media and training systems for Industry 4.0.

www.boschrexroth.com/academy

Scan the QR codes for explanatory videos
The training contents: a sophisticated concept, suitable for all fields of education – and a training system that will grow with the requirements

Knowledge is power – Employees’ specialist knowledge and expertise create a decisive advantage in the competitive global market. Under the umbrella of the Drive & Control Academy, Rexroth provides a consistent, practically focused range of knowledge products – suitable for all fields of education. Using the mMS 4.0 training system as an example, you can see the applications in the different educational fields. A flexible system that grows with your needs.

Vocational education

- Exercises for training to become a mechatronics engineer
- Getting started in robotics and CNC programming
- Understanding safety technology

Getting started with Industry 4.0:

- Using tablets and smartphones in an industrial environment
- Learning about integrated augmented reality
- Applying apps for status information and error recognition
- Operating the system (production line and robots) using apps via OCE (Open Core Engineering)
- Identifying opportunities for the use of RFID in manufacturing
- Customization of manual workstations using RFID or other identification possibilities
- Understanding an industrial plant (from production to the MES and ERP systems)
- Understanding horizontal and vertical communication using the ActiveCockpit
- Installing, setting up and implementing communication via open standards
- Understanding approaches to distributed intelligence and analyzing communication between systems
- And many more Industry 4.0 topics

Skill development / Further education

- A general understanding of mechatronics, automation and manufacturing processes
- Advanced programming of robots
- Integration of safety technology

Industry 4.0:

- Rexroth Open Core Engineering (OCE): How to transfer data directly from a controller to an analysis software program without the use of a PLC program
- Receiving and storing data from the machine by means of the PLC, especially with OCE
- Using big data use to analyze information and to depict it on the ActiveCockpit (e.g. energy efficiency, production deviations,...)
- Setting up and understanding predictive maintenance
- Setting up and understanding automatic service alerts
- Integration of troubleshooting for the ActiveCockpit (such as a selection of possible errors, repair videos ...)
- Integration of RFID-assisted manufacturing
- Integration of an MES or ERP system
- And many more Industry 4.0 topics
Polytechnics / Universities

- A general understanding of mechatronics, automation and manufacturing processes
- Planning and implementation of machine communication vertically and horizontally using open standards
- Setting up of systems with decentralized controls and integration into an overall system
- Implementation of self diagnostics in decentralized machines, as well as the transfer of this status in networked systems

**Industry 4.0:**

- Rexroth Open Core Engineering (OCE) – the university as a potential industrial partner for programming
- Develop new apps (Java) for ease of use
- Use simple, standard tools for quick access and the simple programming of an industrial PLC, such as LabVIEW, MATLAB/Simulink, C/C++, C#, Lua
- Use Visual Basic for Applications (VBA) for direct access to PowerPoint and Excel
- Use mobile devices (tablets and smartphones), rather than industrial HMIs (connection via Wi-Fi or cable)
- Use of Wi-Fi connections for the industrial sector
- Develop safety concepts
- Use Rexroth control systems as connections (server) with MES systems
- ERP systems – find efficient solutions
- And many more Industry 4.0 topics
As a leading specialist in drive and control technology and a promoter of Industry 4.0, Bosch Rexroth has a unique level of expertise. We are keen to pass on this knowledge. In the Drive & Control Academy, we support customized education and training, as well as the certification of technical experts – focused on the requirements of Industry 4.0.

Everything offered at the Drive & Control Academy is based on the same principles:

- State-of-the-art **equipment geared towards real life with original standard components** – for example the featured mMS 4.0 modular training system, with which you can already simulate a complete Industry 4.0 capable factory.

- **Target group specific training** – for Industry 4.0, the basis is the mechatronics curriculum.

- **Modern teaching methods and media** – offering a comprehensive range of videos and animations about Industry 4.0 in the Rexroth LearnWorld.

Find out more: [www.boschrexroth.com/academy](http://www.boschrexroth.com/academy)
The Bosch Group is one of the largest training institutions for technical professions worldwide. Operating more than 270 production sites and with the knowledge of what is needed in industrial practice in a networked world. Bosch Rexroth makes this knowledge of the latest technical trends and innovations directly available – across all technology areas. An offer that is truly one-of-a-kind.

**Our training fields**
- Industrial Hydraulics
- Mobile Hydraulics
- Electric Drives and Controls
- Pneumatics
- Automation/Mechatronics
- Linear and Assembly Technology
- Safety Technology
- Energy Efficiency
- Industry 4.0
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