

# Aerospace Manufacturing

## Building the Factory of the Future – Today



# Meeting the needs of the aerospace market

Increase safety, quality, and productivity in automated and manual operations with the expert assistance of Bosch Rexroth.

- ▶ Additive manufacturing
- ▶ Cutting
- ▶ Stamping
- ▶ Broaching
- ▶ Drilling
- ▶ Milling

**Products to support machining and forming**

- ▶ Lean manufacturing
- ▶ Conveyors
- ▶ Manual workstations
- ▶ Robotic assembly

**Products to support Tier One suppliers**

- ▶ Riveting
- ▶ Tape laying
- ▶ Joining
- ▶ Dispensing
- ▶ Holding and positioning
- ▶ Bolt inserters

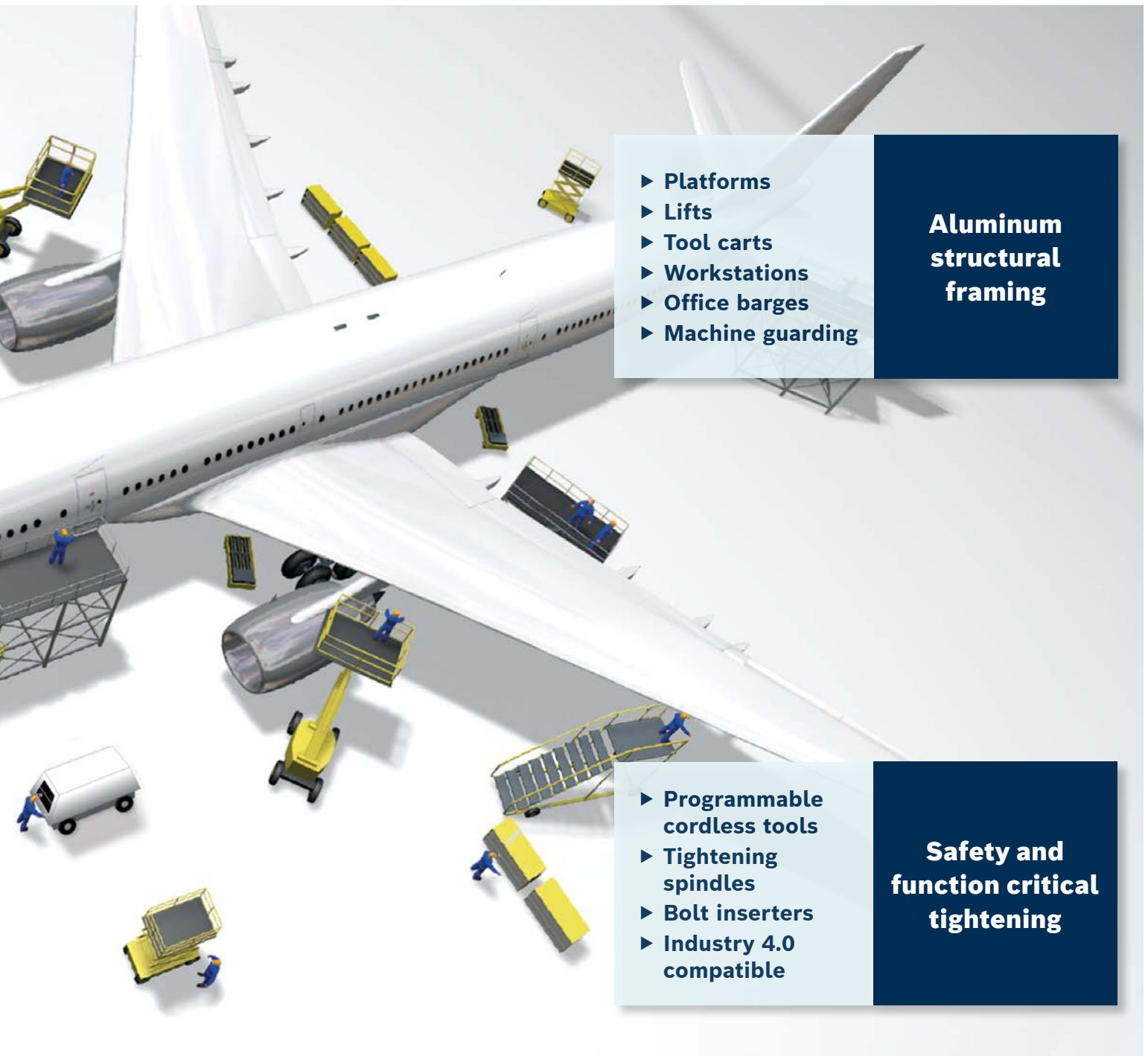
**Products to support fastening and lay-up operations**

- ▶ Skydrol systems
- ▶ Central systems
- ▶ Proportional/servo valves
- ▶ Flight simulators
- ▶ “Back to New” Repairs

**Rexroth hydraulic systems support**



**Solutions and products that are  
reliable, scalable, and freely combined  
according to your needs.**



- ▶ Platforms
- ▶ Lifts
- ▶ Tool carts
- ▶ Workstations
- ▶ Office barges
- ▶ Machine guarding

**Aluminum  
structural  
framing**

- ▶ Programmable  
cordless tools
- ▶ Tightening  
spindles
- ▶ Bolt inserters
- ▶ Industry 4.0  
compatible

**Safety and  
function critical  
tightening**

# Innovative concepts ready for the future

## Products and engineering support for the Internet of Things and Industry 4.0: Realizing the Factory of the Future, today

Smart manufacturing will realize the promise and potential of Industry 4.0. In many cases, a tipping point has been reached, where machine builders and manufacturers are actively engaged in implementing smart manufacturing systems. Based on our experience in pilot projects in our own plants, we have identified seven essential features that are necessary for the implementation of Industry 4.0.



### People as key players



The Factory of the Future is not just a building full of robots. Rexroth will work with you to insure that I4.0 concepts are applied in a user friendly and truly beneficial manner. From digital assistant functions and intelligent workplace design to big data boiled down to actionable performance indicators, we put people at the center of the factory of the future.

### Distributed intelligence



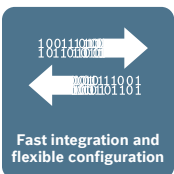
Decentralized intelligent automation components with integrated software perform their tasks independently, according to the specifications of higher-level systems, and make autonomous decisions.

### Digital life-cycle management



The comprehensive networking of all automation components, machines, processes and product data – from development and production to recycling – decreases development time and therefore development costs, for both completely new smart manufacturing lines and upgrades to existing platforms. In addition, this also ensures the application-oriented design of all components.

### Fast integration and flexible configuration



With Plug and Produce, people, machines, processes and the flow of goods are networked together on an ad hoc basis. Software tools simplify multiple smart manufacturing machine steps: commissioning, integration and (re) configuration, as well as preventive maintenance of all components, modules and machines.

### Open standards



Open Standards that extend across manufacturers and are platform-independent form the basis for horizontal and vertical integration and thus for the seamless exchange of information in value-creation networks.

### Secure value-creation networks



Security and safety for Industry 4.0 includes protecting people from machinery-related hazards (safety) as well as the protection of production facilities and corporate IT from attacks and faults from the surrounding environment (security). This involves securing sensitive data as well as the prevention of intentional and unintentional malfunctions.

### Virtual real-time representation



All components and objects are represented as virtual real-time representations across the entire value creation process. These virtual elements are closely linked to their physical counterparts and provide in-context information for continuous process improvement in real-time.

# Connect to a new era of hydraulics



## The Future of Hydraulics is Here

### Sytronix – Energy efficient pump drives



Rexroth's Sytronix variable-speed pump drives offer reduced energy consumption – up to 80% while reducing CO2 emissions, lower noise emission – noise reduced by up to 20 dB(A), reduction of operating costs, reduction of space requirement, and increased operational safety.

### CytroBox – Connected / Quiet power unit



Today, the latest power units already boost efficiency in production with their energy-efficient operation, innovative design and intelligent connectivity. With CytroBox, we are revolutionizing hydraulic supply units and are sustainably changing people's perception of hydraulics. We are writing a new chapter in the history of hydraulic drive technology.

### Proportional Valves – High response



Control Valves – High Response 4WRLE and 4WRPEH type high response directional valves offer fast response, minimal hysteresis, and are excellent performers in closed loop systems. The on-board electronic valves low maintenance and used in difficult environments. The robust design with proven reliability in high stress applications.

### CytroPac – Compact/Variable Speed power unit



The compact CytroPac hydraulic power unit is a revolutionary solution for machine tool design. With every HPU function packaged into one unit including a Sytronix variable-speed pump drive, i4.0-enabled interface, and a no-hassle cooling and degassing tank design, the plug-and-play CytroPac can help you achieve new levels of productivity.

### Large Systems: Rexroth offers a wide array of engineered turn-key systems



### Flight Simulators / eMotion Systems:

Rexroth offers driven 6dof motion platforms



### Hydraulic Repair Centers – Trust in Rexroth

#### Factory certified service and repair for all Rexroth products

With the original expertise, original spare parts, and original quality from Bosch Rexroth, you will receive professional experience and complete knowledge of the life-cycle of the products and the benefit that no other service provider can offer.

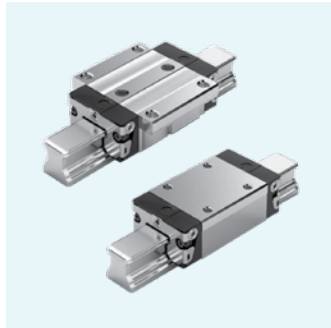


# Automation Technologies

## A Complete Automation Solution for Industry 4.0

### Linear Technologies

### Drives & Controls



**Ball Rail™ Systems**  
 Primarily designed for machining centers and general automation equipment, Ball Rail Systems from Rexroth add more value to manufacturing processes thanks to fast, high-precision guidance and long service life. In highly competitive markets like machine tool these systems consume 90% less energy and offer critical efficiency.



**Electromechanical Cylinder – EMC & EMC-HD**  
 The EMC is a robust electromechanical cylinder used for heavy duty applications with high load forces under tough conditions. The integrated precise planetary screw allows accurate movement and positioning and a long service life.



**EasyHandling**  
 EasyHandling is a complete platform for the easy design, construction, and commissioning of Cartesian motion robots. It combines open, user-friendly programming environments with precise and reliable linear componentry to create the most accessible, easy-to-use Cartesian motion robot.



**Tychoway Linear Roller Bearing**  
 Tychoway recirculating Linear Roller Bearings provide predictable, repeatable positioning accuracy with minimum service requirements. A diverse range of sizes allows use in applications from compact diesto large machine tools. Tychoway Bearings have static load capacities rated from 4,330 to 122,000 lbs.



**ctrlX Automation**  
 ctrlX surmounts the classic boundaries between machine controls, the IT world, and the Internet of Things. With a Linux real-time operating system, consistently open standards, app programming technology, web-based engineering, and a comprehensive IoT connection, ctrlX AUTOMATION reduces components and engineering costs by 30 to 50%.



**ctrlX Safety**  
 Bosch Rexroth is redefining safe automation: ctrlX SAFETY is the most compact safety solution of its kind and has the fastest reaction times. The compact yet scalable system can be used as required—from the drive-integrated SafeMotion solution in ctrlX DRIVE to the complete ctrlX SAFETY control system.



**IndraDrive Mi**  
 IndraDrive Mi enables machine manufacturers to integrate all electrical drive components directly into the machine resulting in cabinet free, modular machines with less required space. The simple system design offers up to 90% less wiring, minimal control cabinet volume, and a drastically reduced cooling load.

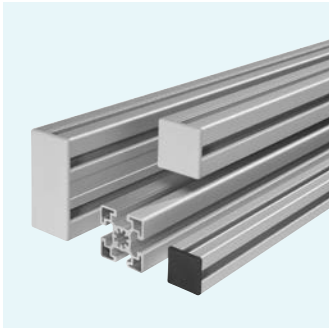


- Connected Sensor – XDK**
- Accelerometer
  - Gyroscope
  - Magnetometer
  - Humidity Sensor
  - Pressure Sensor
  - Temperature Sensor
  - Acoustic Sensor
  - Digital Light Sensor

# Assembly Technologies

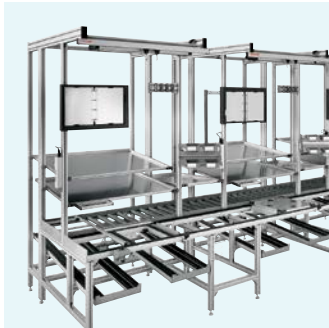
## Everything to Build Anything

### Aluminum Framing/ Conveyors



#### Aluminum Structural Framing

Our aluminum framing line is the most extensive. With hundreds of profile variants and thousands of products for joining, finishing, and moving elements, any type of support structure, enclosure, or machine base is possible. Includes options for ESD, clean and dry room applications.



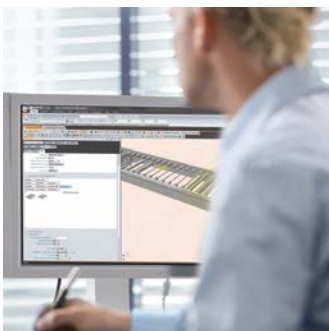
#### Manual Production Systems

The main concern of modern production is to avoid waste. The MPS Manual Production Systems from Rexroth have been developed strictly in line with aspects for lean production, enabling simple and fast planning, and implementation of lean production installations.



#### Guarding Systems

Bosch Rexroth offers a wide range of machine and perimeter guarding options for creating physical enclosures, guards, and barriers to protect workers. Partitions can be constructed from pre-assembled, ready-to-use components that install quickly and easily integrate into other Rexroth aluminum framing structures.



#### Conveyor Systems

Transfer of parts, sub-assemblies, and structures needs care in both physical handling and traceability. With Rexroth conveyors many options exist, from the VarioFlow flexible plastic chain conveyors to pallet based TS assembly conveyors for light to heavy applications. Best of all, the lines all accommodate RFID tracking.

### Tightening Systems



#### Control and Power Electronics

Powerful and sturdy—the new hardware platform is based on cutting-edge technologies and thus ensures investment security. It has been specially developed for industrial applications. The system box and compact system fully comply with the IP54 protection class.



#### NEXO Handheld Nutrunner

With NEXO, the entire controller is located in the nutrunner—an innovation that makes many Industry 4.0 applications possible for the first time. The integrated control systems enable the wireless cordless nutrunners to be connected directly to the higher-level systems without any additional hardware.



#### Tightening Spindles

With a working range between 0.6 and 1000 Nm and a choice between straight output drives, offset output drives, feed output drives, and angle heads—with Rexroth components you can configure a tightening spindle that is customized to your individual requirements.



#### Bosch Production Tools

Bosch cordless and electric screwdrivers form an advanced family of production tools that make the assembly process easier, faster, safer, and more accurate. The EXACT series of assembly tools from Bosch—incredibly accurate, durable, and energy-efficient.

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