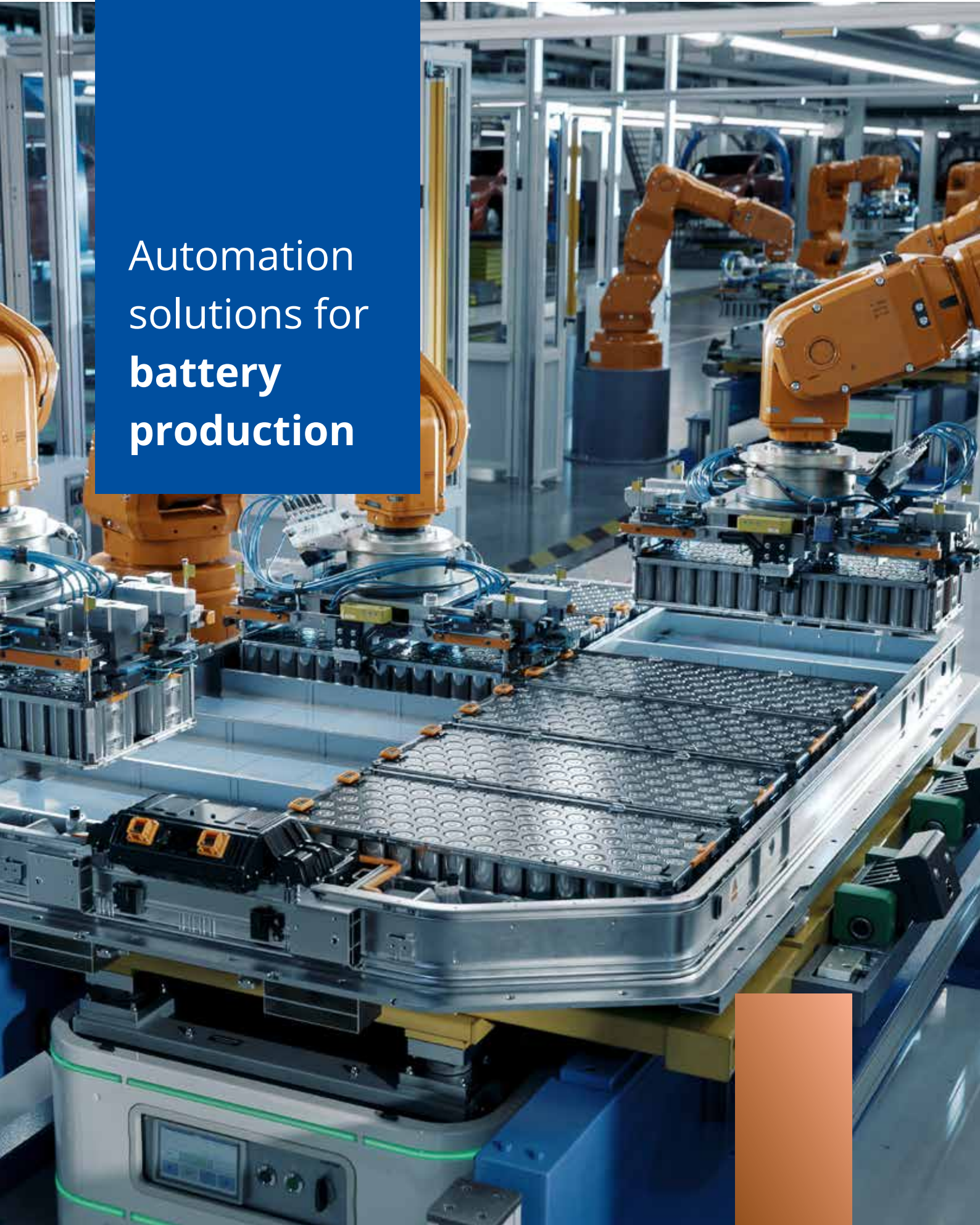


Automation  
solutions for  
**battery  
production**



**Winding,  
conveying,  
robotics ...**

Over 75 years  
of experience  
in automation  
and drive  
technology



**As one of the leading specialists in automation and drive technology with extensive expertise and a global network, we take a holistic view of battery production – from battery manufacturing to handling and logistics.**

In the field of battery production, important machine applications are part of our DNA – our decades of experience in winding technology is an example of this. With the help of prepared and tested software modules, you can easily transfer this experience to your application.

**Benefit from the combined know-how and support of our experts worldwide:**

- Efficient automation solutions based on a holistic automation system consisting of modular software and scalable hardware
- Reliable drive systems for typical and challenging applications
- Integrated engineering
- Use of open standards
- Fast commissioning
- Adaptable production systems
- Short time-to-market
- Machine transparency through consistent data utilization
- Worldwide logistics concept
- Global service network and training offer



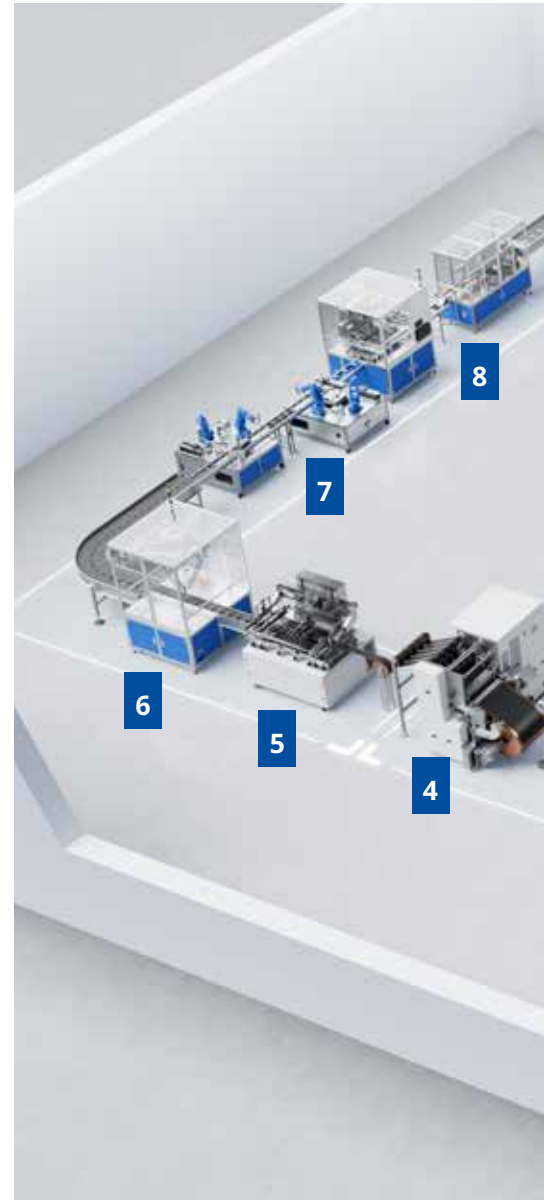
# Always the right automation and drive solution: from cell production to the module to the battery pack to to warehouse logistics.

**A critical step in cell production for lithium-ion batteries is the high-quality processing of the metal foils into electrodes and the final joining of the electrode and separator foils. Here, highly synchronized movement of all process axes in automation is the core of fast and good cell production. These challenges in automation are in many parts similar to those in converting and printing processes – an area of automation in which Lenze has many years of application experience and technological depth.**

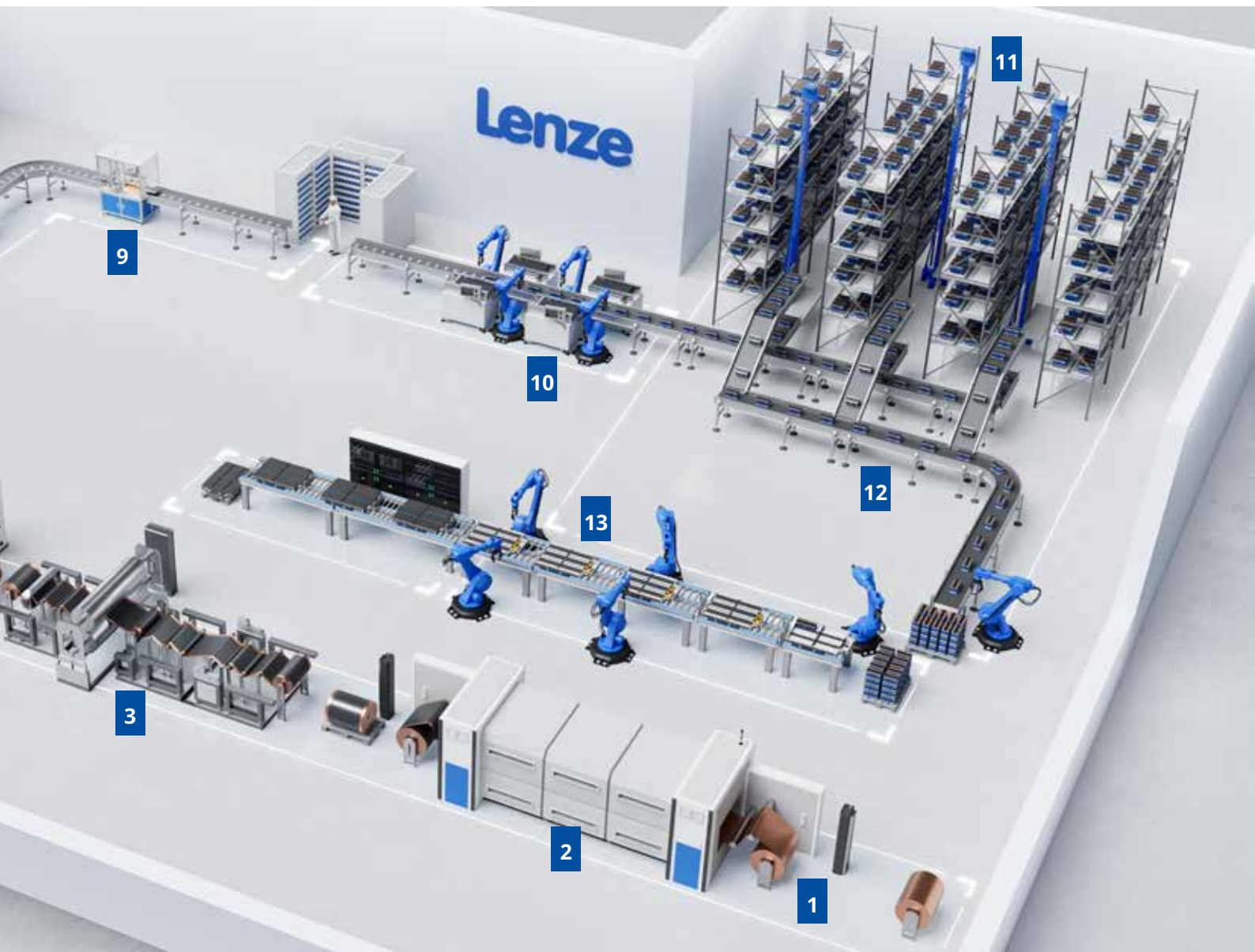
Typical challenges include applying and removing thin metal foils while simultaneously using other synchronous processes such as substrate coating, calendering or cutting. Currently, some process steps are carried out in separate machines (calendering), other steps in a complete system concept (coating and drying).

Lenze expertise can also play a decisive role for you in upstream and downstream process steps:


- The transportation or movement of raw materials in gantries, lifting units and on turntables and with horizontal conveyor technology
- Handling goods in a high-bay warehouse with pallet and container storage and retrieval machines
- Robotics applications in battery assembly with simultaneous movement of the conveyor belt



- 1 Foil pre-processing
- 2 Coating (incl. drying)
- 3 Calendering
- 4 Slitting
- 5 Notching



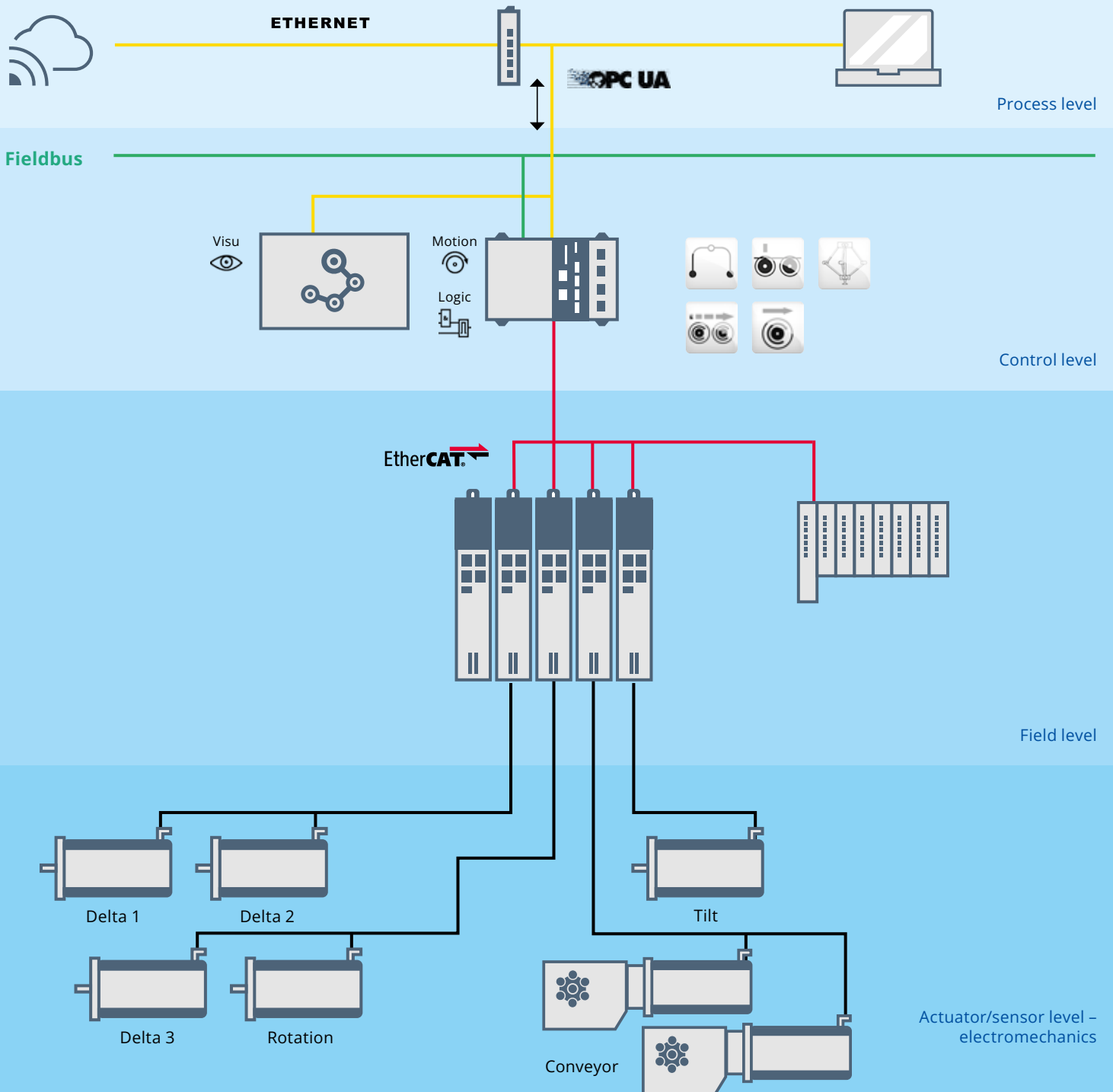
- |                                   |                                |
|-----------------------------------|--------------------------------|
| <b>6</b> Stacking pouch           | <b>11</b> AS/RS                |
| <b>7</b> Packaging                | <b>12</b> Horizontal conveying |
| <b>8</b> Filling, sealing         | <b>13</b> Pack assembly        |
| <b>9</b> End-of-line quality gate |                                |
| <b>10</b> Module assembly         |                                |




Pick & place:  
**Fast sorting  
and precise  
alignment  
during the  
ongoing  
process**

As the most flexible component of a machine, the Delta robot is the first choice for customized production. This supports fast sorting according to cell quality levels and precise alignment on the moving conveyor belt at the end-of-line quality gate.

- Lenze FAST technology modules enable **parameterization instead of programming** without deep robotics knowledge
- **The openness of our software** means you remain independent and can contribute your individual core expertise
- **The integration of robotics and machine control in one controller** ensures efficient engineering
- **Simple connection of peripherals**, such as camera, conveyor belts, etc.
- **Uncomplicated connection to the MES/ ERP system**, e.g. for Track & Trace functionality, recipe management, machine management





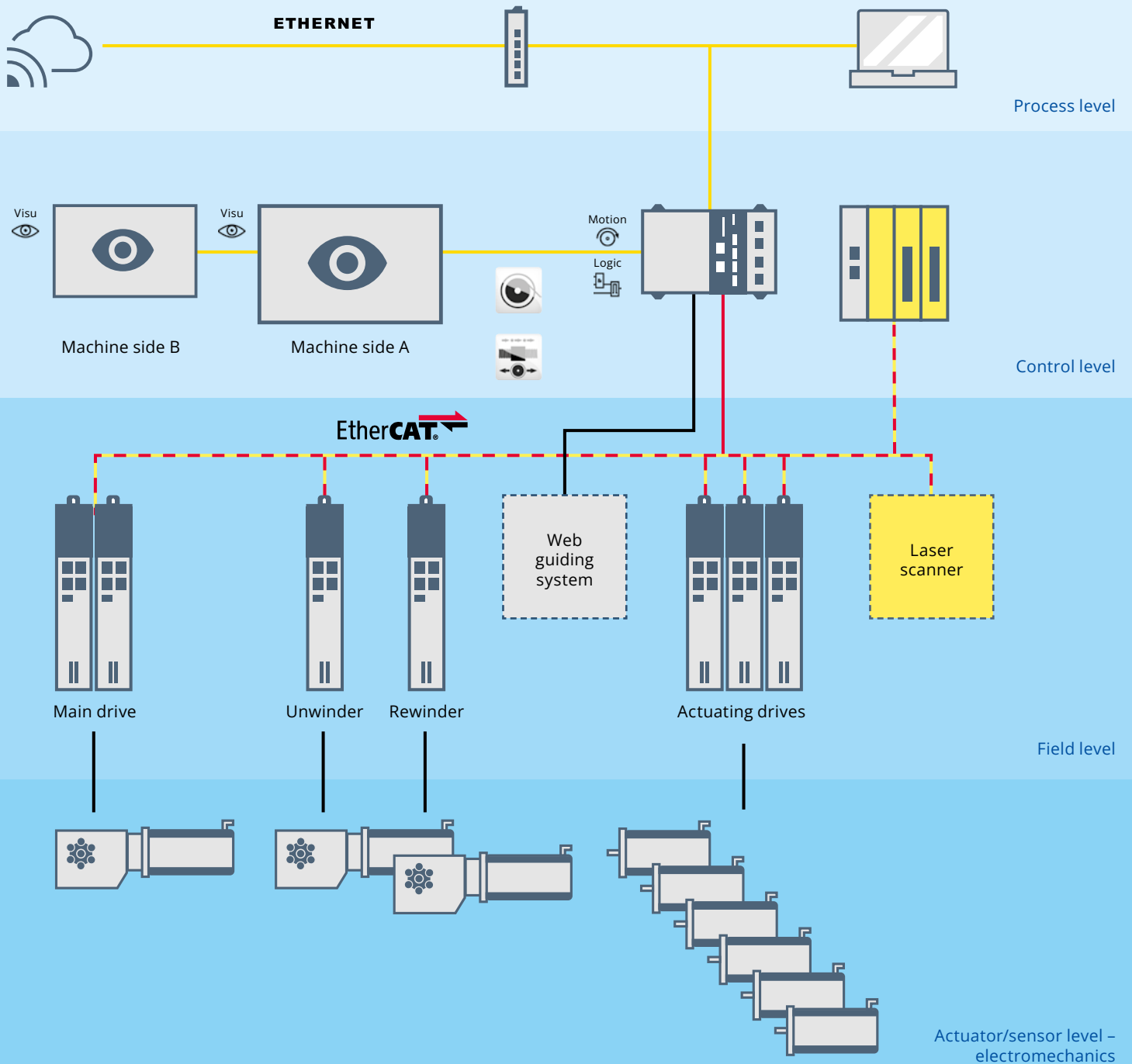
Slitter rewinder:  
**Wound safely  
and precisely**


The winding and unwinding of thin metal foils with the simultaneous application of other synchronous processes is one of the core requirements of battery production.

– Integrated automation solutions from Lenze and the Lenze FAST software module "Winder" reduce engineering costs, increase productivity and improve the quality of the application:

- Based on 75 years of experience in the field of winding
- Reduced winding drive power by full usage of the field weakening range
- Integrated torque and diameter calculator for reduced expenses on sensor technology
- High winding quality thanks to disturbance compensation (friction, acceleration)
- Easy operating mode changeover with assignment of product-specific winding characteristics for fast product changes
- **Less wiring efforts** due to pioneering EtherCAT/FSoE topology



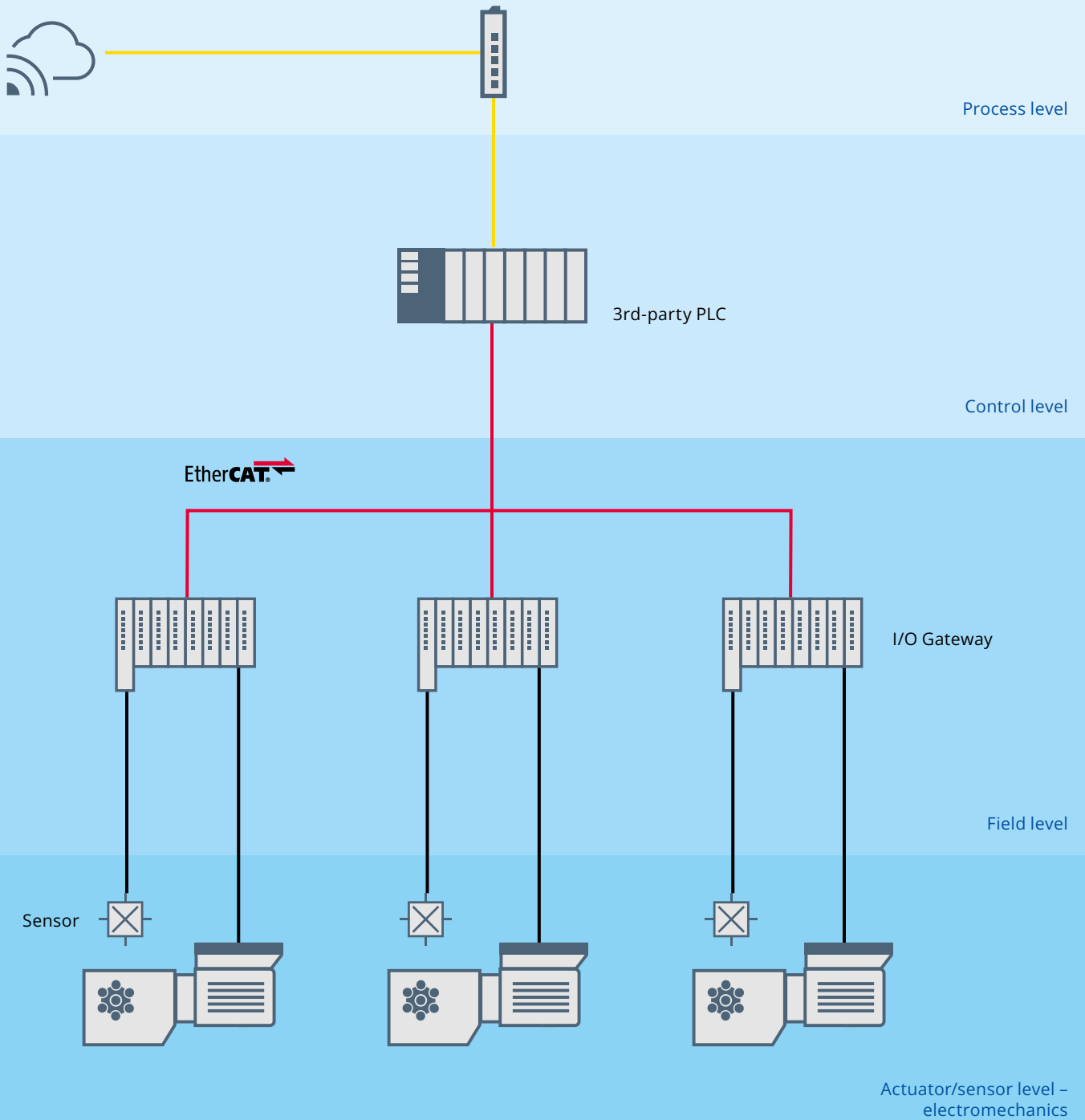





Belt, roller and  
chain conveyors:  
**Efficiency on  
the run**

**Simple and efficient decentralized drive solution for variable and fast conveying speeds in horizontal conveyor technology.**

- **Reduced energy consumption** through savings in idle and partial load operation and through the use of energy-saving functions
- **Gentle start-up and braking** with adjustable ramps protects material and conveyed goods and reduces maintenance costs
- **Minimal installation and wiring effort** thanks to decentralized drive concept
- **Compact drive solution** for constant speeds, even with heavy loads
- **IO-Link master functionality** for simple data exchange and extended communication

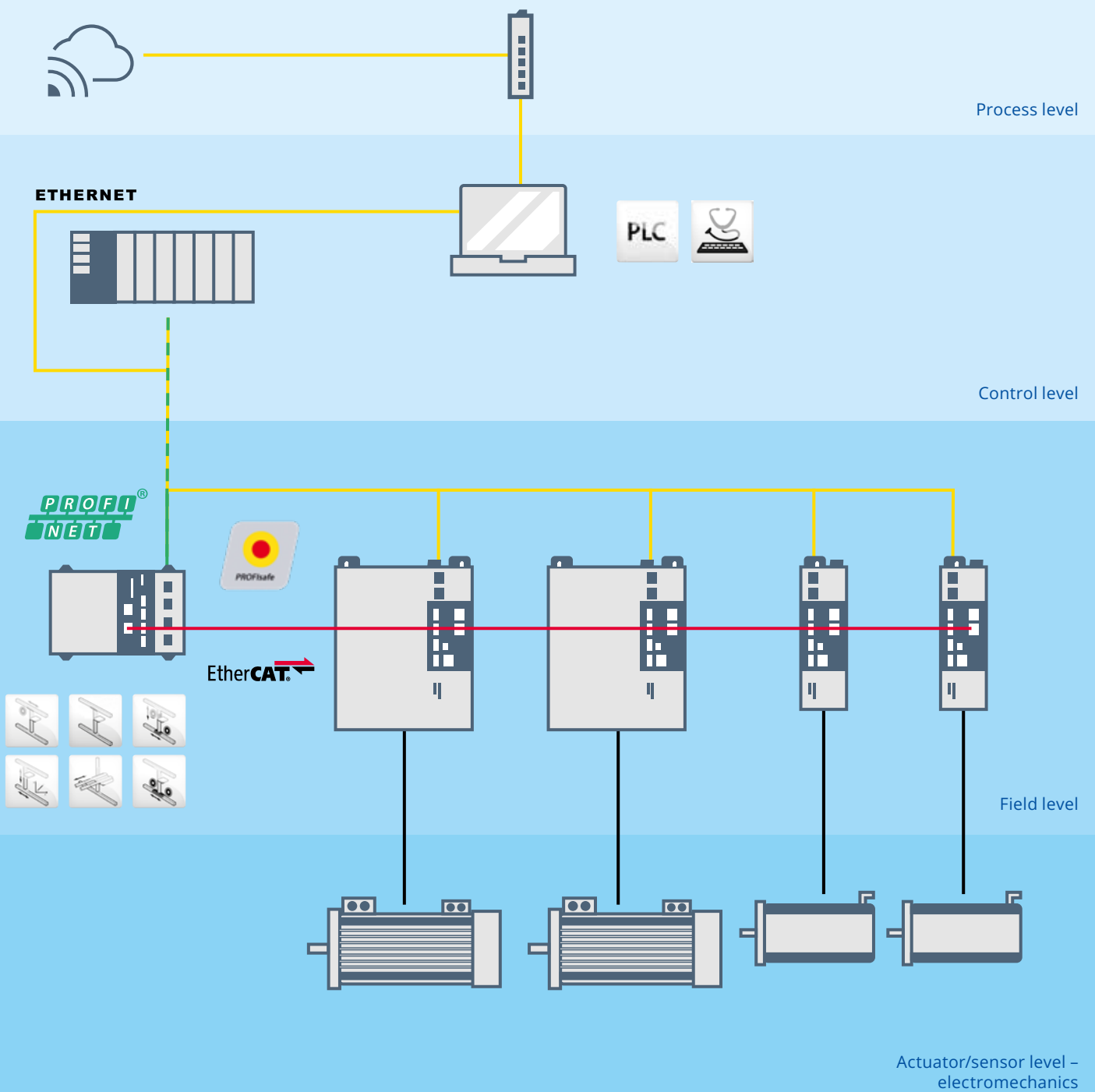




Automated  
storage and  
retrieval  
systems  
(AS/RS):  
**Highly  
automated  
storekeeper**

**Complete solution package for pioneering next-generation storage and retrieval systems.**

- Simple software engineering thanks to prepared **Lenze FAST machine solution "Storage and retrieval system"**
- **Reduction in mast oscillation** ensures higher system performance
- More available storage capacity due to **reduction or elimination of buffer zones**
- **Reduced energy consumption** thanks to DC link connection of travel and lifting drive
- Energy recovery units for **optimum energy balances**
- **Enhanced safety functions** increase safety and reduce costs at the same time





**Enthusiasm  
and problem-  
solving  
expertise  
for battery  
production**

#### **Global growth in the production of lithium-ion batteries**

The battery production ecosystem is developing rapidly in various regions of the world. Now is the right time for the mechanical engineering industry to tap into this business segment. The growth potential for battery production plants is enormous worldwide and especially in Europe.

The pressure on quality, time-to-market and costs is constantly increasing. Flexible production that can be adapted to new technologies and changing formats pays off.

**Reduced engineering costs**

Shorter innovation cycles, higher customer requirements, a growing demand for tailored products and services as well as the shortest time-to-market are challenges faced by every machine builder.

Efficient engineering is essential:

- An engineering tool chain that ensures system continuity is the basis of engineering logic, visualization, safety, security, and motion.
- Pre-defined and tested modules that provide basic functions cut down on engineering costs and market introduction time.
- Modularization and scalability in software and hardware ensure flexibility and adaptation of the machine design.

**Future-proof system**

For new, upcoming challenges, you require an open and highly modern system:

- Standard interfaces such as OPC UA for horizontal and vertical integration
- Simple integration of intelligent sensors
- Industry-standard interfaces for integrating third-party products
- Open operating systems for the use of third-party software
- Simple and popular programming options
- Web-based visualization for use with standard browsers

**Smart factory support**

Support for connectivity, digitization and efficiency:

- Machine-to-machine communication
- Artificial intelligence with closed control loop for the machine parameters
- Access control and security mechanisms for an open yet secure solution
- Vertical integration into MES, ERP or cloud solutions
- Data collection and informative aggregation
- Big data analytics for performance assessments
- OEE improvement via error and state analysis
- Predictive maintenance and remote machine monitoring

**Safe and smart machines**

An integrated safety solution offers multiple advantages:

- Reduced space requirements for the machines while ensuring shortest response times and constant operation
- Easy expandability and less wiring through the use of a safety bus system
- Lower system costs by reducing the space requirements and wiring complexity
- Intelligent responses, e.g. reduced speed instead of machine shutdown
- Better fault diagnostics thanks to more detailed error descriptions

**Rapid and cost-efficient diagnostics and maintenance**

How your customers receive rapid and efficient assistance in the event of an unplanned machine stop:

- Clear diagnostics data allowing rapid identification of the cause
- Easy access via remote login with full access to the visualization and the control system
- Automatic download of parameters and firmware when hardware is replaced
- Predictive maintenance for avoiding emergency scenarios
- Use of sensors and data analysis

# Integrated automation systems from the drive to the cloud: **Scalable for your machine**

## Comprehensive and open

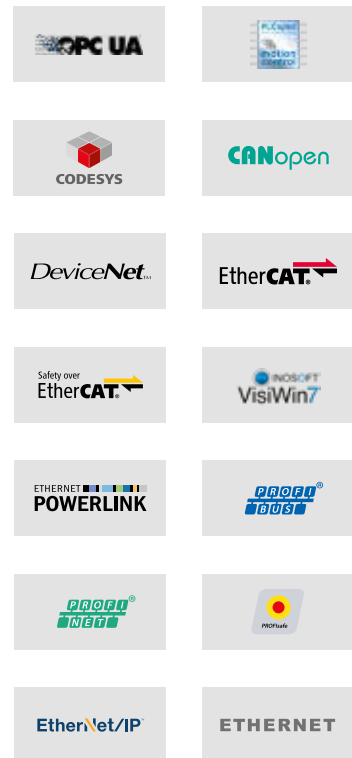
Lenze automation systems offer you everything from the control level to electromechanics for the realization of a wide range of tasks. Thanks to our energy-efficient mechatronic portfolio of reliable technologies, you benefit from long-lasting quality and easy handling of all our products.

Furthermore, machine automation systems implemented with us are open to the efficient integration of components from various suppliers.

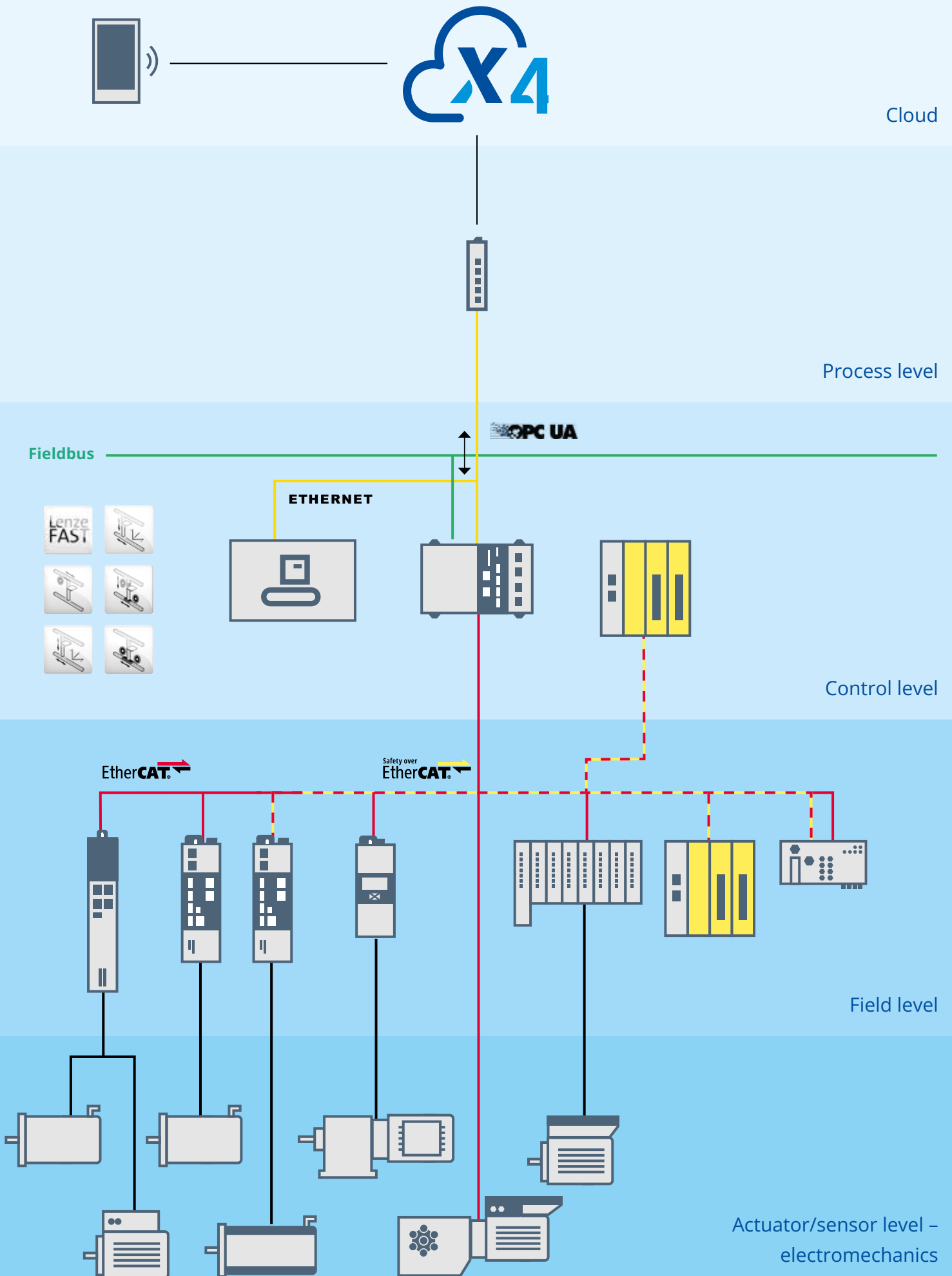
## Compliance with market standards

The consistent use of market standards enables simplified communication with other control and drive systems. This also applies to integration into higher-level line structures.

This openness makes mechanical engineers and users confident of being able to adapt to changes in the future. Keep your core expertise in-house and hold on to your competitive advantage.







Efficient  
software  
engineering  
with  
**Lenze FAST**



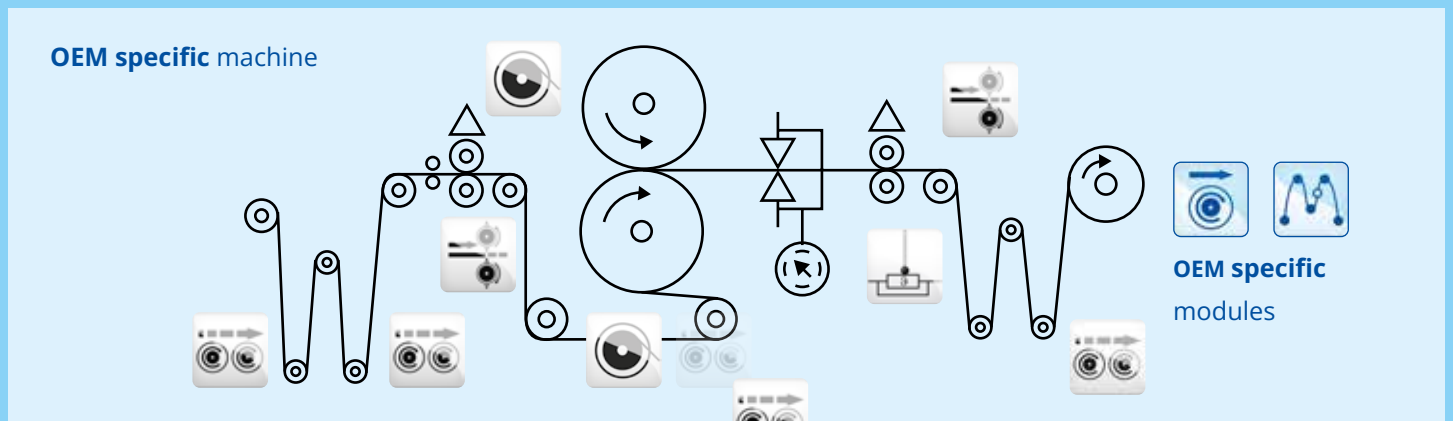
Lenze FAST is based on the experience of **thousands of realized applications.**

**The engineering process is becoming increasingly digital. Whether it is a question of higher machine flexibility up to batch size 1 or improved productivity - machine software is increasingly coming into focus.**

Our modular software system, the Lenze FAST Application Software Toolbox, incorporates the experience from several thousand realised applications. Ready-made and tested technology modules reduce development time for technology-specific basic functions, thereby simplifying the implementation of machine functions.

For better software quality, the technology modules can easily be reused. They can be used directly by the machine builder or form the basis for the development of custom modules, thus allowing a machine to be programmed efficiently. A structured programming layout is realized via the Application Template.

### FAST Application **Template**



### FAST **Technology Modules**



# Lenze

engineered to win

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