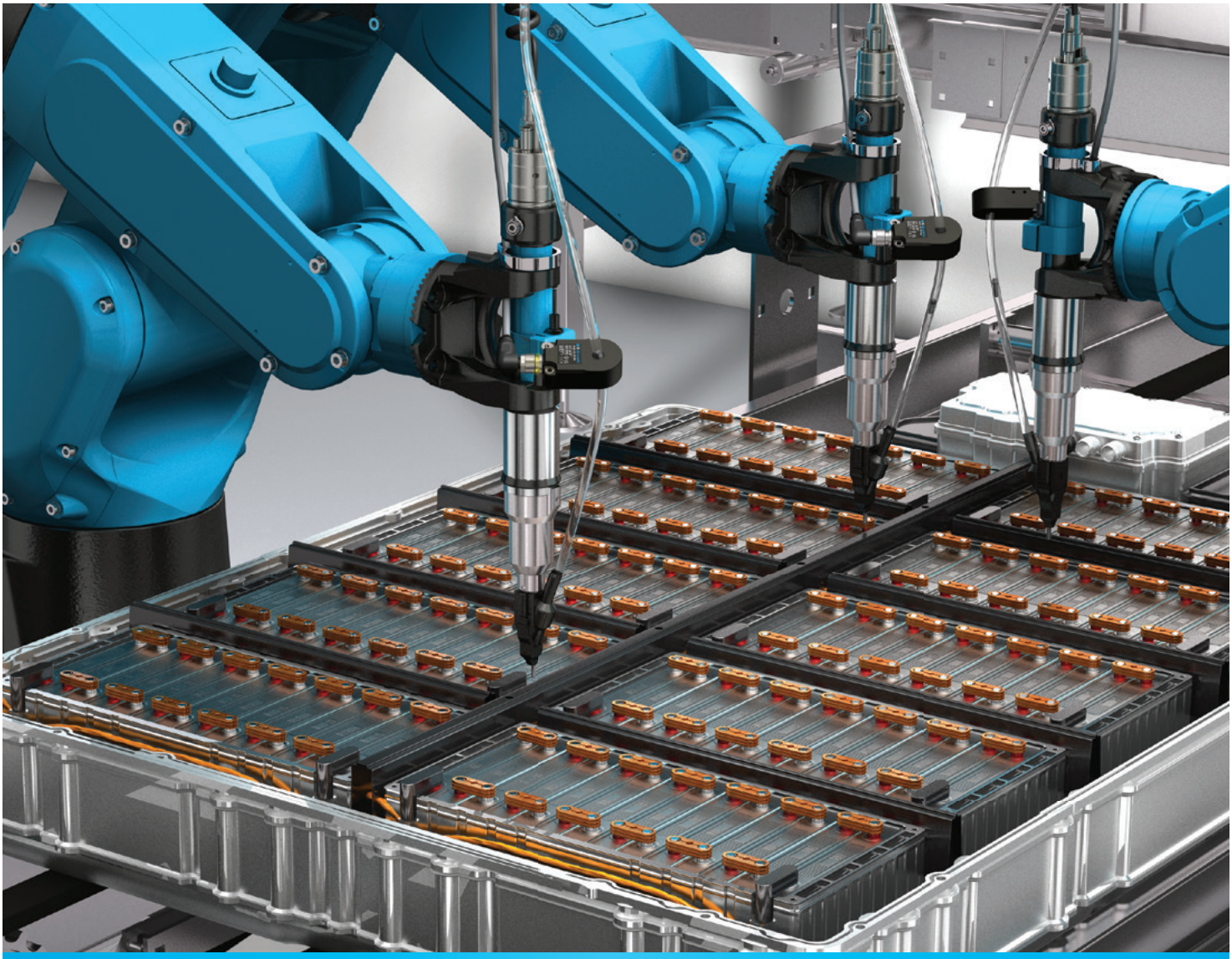


BATTERY PRODUCTION

di-soric

WELCOME
TO DI-SORIC

Over 40 years of experience in the development and production of solutions for industrial automation

- **100% owner-managed**
- **Headquarters**
  Urbach, Germany
- **Technology and production center**
  Lüdenscheid, Germany
- **Representatives and branch offices**
  in more than 40 countries
- **Certifications**
  IQNet, ISO 9001:2015, ISO 14001:2015

For over 40 years, di-soric GmbH & Co. KG has been producing and selling sensors featuring a wide variety of technologies. These sensors are used in industrial automation – primarily in assembly and handling technology, in the automotive, electronics and pharmaceutical industries and in packaging technology. Other important cornerstones of our product range are innovative vision sensors and code readers, and high-quality LED lighting for machines and image processing.

Our own ambition is to benefit you. When we develop products and solutions to handle your tasks, we alway strive to make them both as simple and as practical as possible.

We draw upon our high level of technical know-how and a clear view of the developments of tomorrow to support our customers – today and in the future – with precise, non-disruptive and efficient production processes.

OUR PROMISE TO YOU:

SOLUTIONS.

To us, finding solutions means:

- Targeted consultation and technical expertise for efficient product solutions
- A very broad, high-performance product range

CLEVER.

To us, being clever means:

- Developing products with clear benefits
- Products that are easy to use thanks to clever functions
- Joint dialog for the most efficient and most suitable solution

PRACTICAL.

To us, being practical means:

- Solution expertise with the best possible functionality at affordable prices
- Cooperative and straightforward working relationships for mutual success
- Focus on the key issues for greater efficiency

BATTERY PRODUCTION
WITH DI-SORIC

For precision and maximum productivity from electrode manufacturing to the battery pack

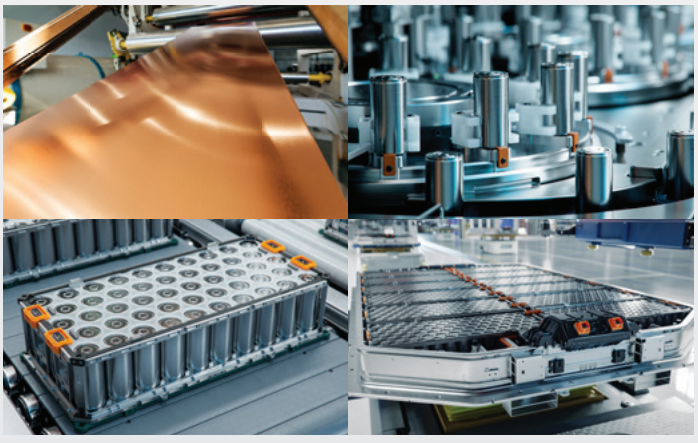
Battery production is a key component of technological innovation in the rapidly growing world of electromobility and renewable energies.

Using state-of-the-art technologies and methods in the key processes of battery production – from manufacturing electrodes to the finished battery pack – increases the efficiency and performance of batteries.

di-soric offers the right solutions for battery production based on high efficiency, flexibility, reliability and easy operation. We understand the value-added processes in the industry. That's why we can help our customers operate their production plants faster, more reliably and more efficiently.

We also offer customized solutions for your specific requirements.

Discover the advantages of di-soric – Solutions. Clever. Practical.



Applications in battery production

OPTIMAL SOLUTIONS FOR BATTERY PRODUCTION

Product solutions from di-soric play a crucial role in the efficiency of battery production applications. Areas of application include the manufacture of electrodes, cells, battery modules and battery packs.

Ultrasonic sensors

USGT Ultrasonic fork sensors

- For determining the position of edges
- High repeat accuracy
- Dirt-resistant

Ultrasonic Barriers/sensors

- Reliably detect transparent, light and dark objects, as well as shiny objects
- Measuring and switching applications
- Operation with teaching line or via IO-Link
- Designs from M8 to M30

Inductive sensors

Ring and tube sensors

- Detect metallic parts fed in supply tubes for further processing
- Part detection, part counting and congestion control
- Flexible integration due to a compact design
- Ring sensors with detection range diameters from 6 – 50 mm

di-soric has impressive products, such as a wide range of high-performance ultrasonic sensors and inductive sensors. The portfolio includes a wide selection of different designs and ranges – each one for a particular application.

Optical sensors

Light barriers/diffuse reflective sensors

- Ideal for quick, secure object detection with the highest operational reliability
- Available in various designs and functional principles, as sensors, reflective sensors and through-beam sensors

Optical distance sensors

- For fast and precise distance measurements
- Measuring ranges up to 10 m
- Resolution down to the micrometer range
- Simple operation using a keyboard or via IO-Link
- Red-light laser with a small laser dot

OGUL Laser fork light barriers

- Ideal for detecting small parts starting at 0.05 mm
- High switching point accuracy
- Simple operation using a potentiometer or via IO-Link
- Fast adjustment with red-light laser and small laser dot

OGWTI Frame light barriers

- Detection of objects starting at Ø 0.7 mm
- Very fast, 0.05 ms response time
- Simple operation using keys or via IO-Link
- 4 sizes, detection ranges of at least 30 x 30 mm up to 100 x 100 mm

di-soric has an extensive portfolio of optical sensors in various models, light sources and operating principles for reliable detection, measurement, and testing of fast-moving objects under challenging ambient conditions.

Vision sensors and ID readers

CS-60 Vision sensor

- High-quality, precise 2D image of the field of view
- Simple localization, detection, counting and measuring of structures in the image
- High-performance ID code reading tools
- Transfer of results and images via various interfaces

ID-600 Fixed-mounted ID readers

- User-friendly, intuitive software
- High-performance reading of ID codes (printed, directly marked (DPM))
- Integrated high power LED illumination in red and white
- Flexible focus due to interchangeable lenses

nVision-i

- User-friendly, intuitive software for di-soric vision sensors and ID readers
- High-performance tools
- Optional modules for flexible adaptation to changing requirements

We offer a wide range of image processing solutions, including easy-to-use vision sensors and image-based ID systems with extremely powerful decoding algorithms for maximum productivity.
The integrated software nVision-i can be expanded with further functions by way of a simple licensing model.

Signal lighting and signal lights

SBT-F / SBT- RGB Signal columns

- 360° status display
- SBT-F: preconfigured color coding per segment
- SBT-RGB: IO-Link configuration of color, brightness, and flashing behavior per segment
- Compact design, high IP67 protection rating

SB-RGB Signal lighting

- Light functions freely configurable via IO-Link
- Segment and level mode can be activated with IO-Link process data
- Large illuminated area for optimal display of the machine status

SBP-RGB Signal lights

- 360° status display, instantly ready for use
- High light intensity at low energy consumption
- Can be controlled with IO-Link process data
- High IP67 protection rating

With the segment and level mode, the multi-segment IO-Link signal lighting can be flexibly adjusted to nearly all possible requirements and used for demanding tasks in many industries.
The signal lights are perfectly suited for display applications.

OVERVIEW
BATTERY PRODUCTION

General sensors, ID readers, and vision sensors from di-soric play a crucial role in the efficiency of applications in battery production. Areas of application include the manufacture of electrodes, cells, battery modules and battery packs.

Electrode manufacturing

When manufacturing electrodes, it is essential to check for sagging, monitor the web edge, inspect the coating and read the code.

Sensors from di-soric are excellent for analog position detection to determine the web edges of highly reflective foils. Precise web edge control enables the reliable processing of materials.

Our solutions ensure maximum precision and quality, optimize part feeding and improve the quality of the coatings.
The continuous identification of the electrode foils provides traceability.

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Cell manufacturing

When manufacturing battery cells, it is crucial to check the diameter of the rollers, monitor for tears, guide the tape and be able to see the machine status.

Our solutions help to optimize important processes and improve the supply of parts. For example, we can optimize sag control by using measuring sensors to ensure that battery cells are produced evenly and without deviations.

This enables precise material processing, early detection of defects and a smooth production process.

Continuous monitoring of the machine parameters ensures the quality of the battery cells and maximizes production efficiency.

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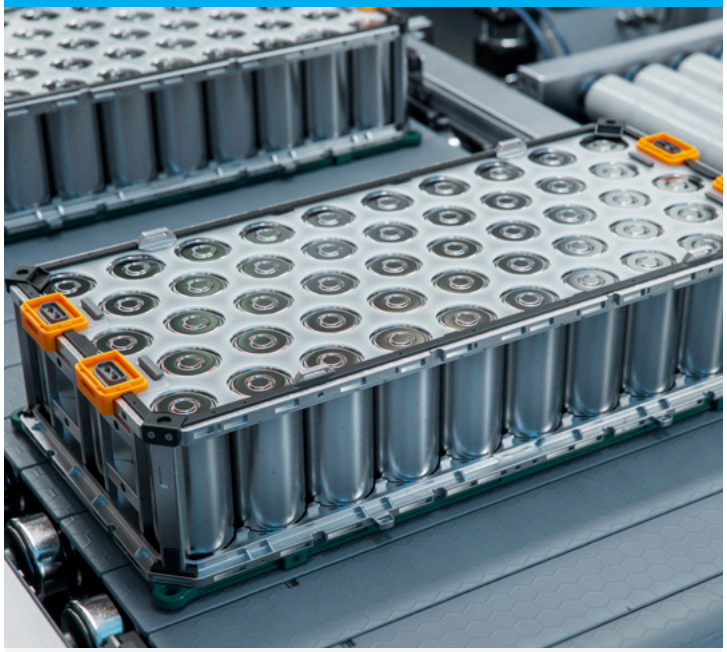
Module manufacturing



In module manufacturing, the incoming cells must be positioned and monitored so that they can be assembled into modules correctly.

Before the end plate is installed, precisely dosed beads of adhesive or sealant are applied to the housing. The end plate is then screwed in place.

With our products, you can be sure that cells are placed precisely, adhesive beading is in the correct position, and screws are fed reliably and continuously.

Precise positioning of the assemblies is crucial when modules are being manufactured. Our sensors and vision sensors ensure high performance and quality for your processes.

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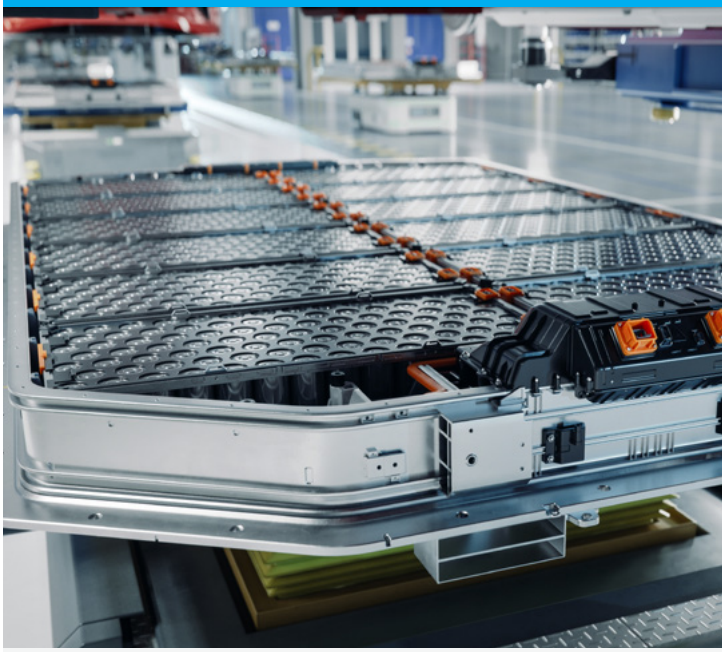
Pack manufacturing



Pack manufacturing involves joining several battery modules together to form a ready-to-install battery pack. Final assembly requires the identification, placement and fastening of electrical and mechanical components.

In pack manufacturing, it is crucial to feed in the fastening screws correctly and to detect whether the pack is complete and in the right position. Products from di-soric ensure that components are assembled correctly and that the vehicle battery will operate safely and for a long time.

Vision and ID solutions reliably read codes and plain text on incoming battery modules and the ready-to-install battery packs. Reliable code recognition improves traceability and supports quality assurance.

The heavy battery packs are often transported by automated guided vehicles. Compact signal lights show workers the status of the mobile manufacturing systems.

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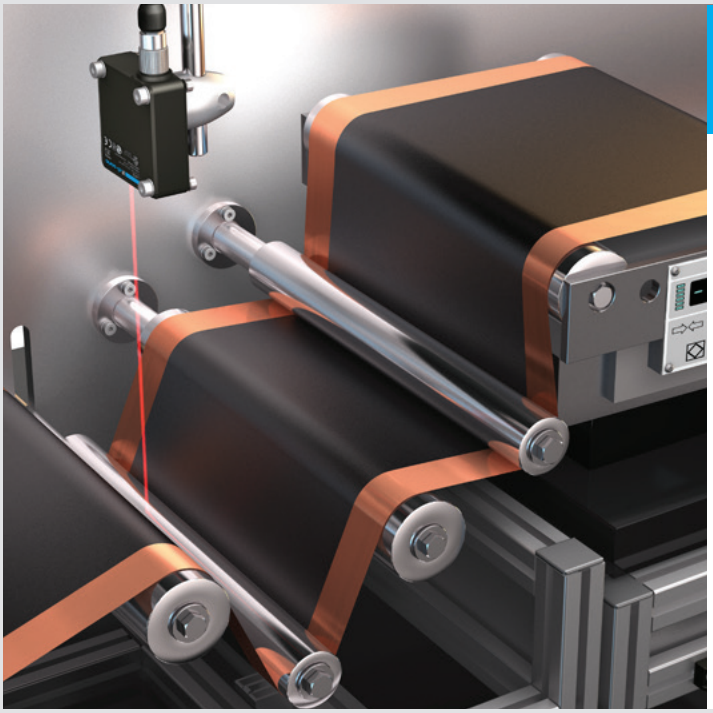
ELECTRODE MANUFACTURING

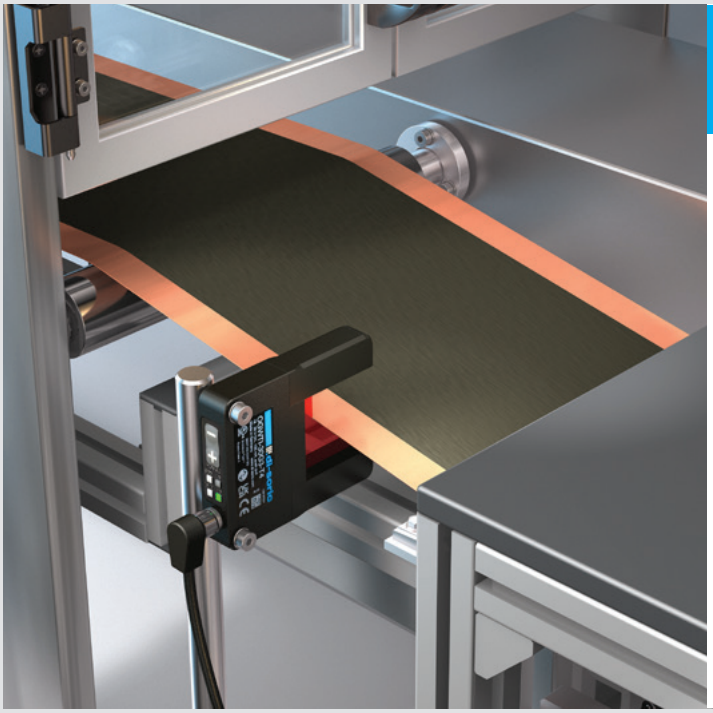
The quality of electrode foils is a key factor in battery performance. Sensors, vision sensors and ID readers made by di-soric are used to check and monitor the process steps. The products therefore play a key role in ensuring the quality of the coating, calendering and cutting of the electrodes.



Loop control system

In a calender machine, it is important to determine the sag of the electrode foil. An LAT-52 series optical distance sensor measures quickly and accurately on a dancer roll. With its easily alignable red-light laser and metal housing, this sensor is optimally suited for such applications.

Optical distance sensor
LAT52-500IU-B5

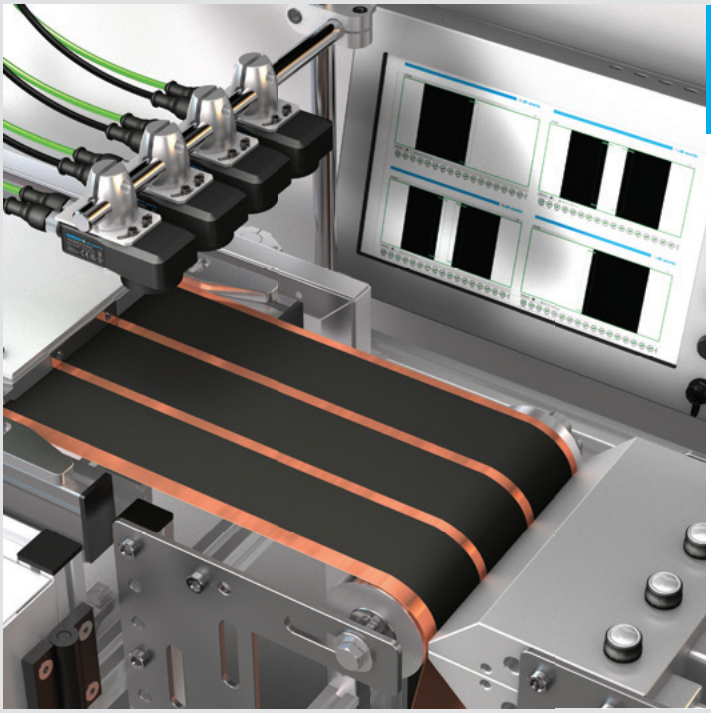


Web edge monitoring

Electrodes are cut by slitting machines. Before the cutting begins, the position of the electrodes must be monitored. The OGWTI series compact frame light barrier uses a “shading” sensor mode to control the edge position of the foil. The position can be evaluated with two fast-switching outputs or as an IO-Link process value.

Frame light barrier
OGWTI-30G3-T4

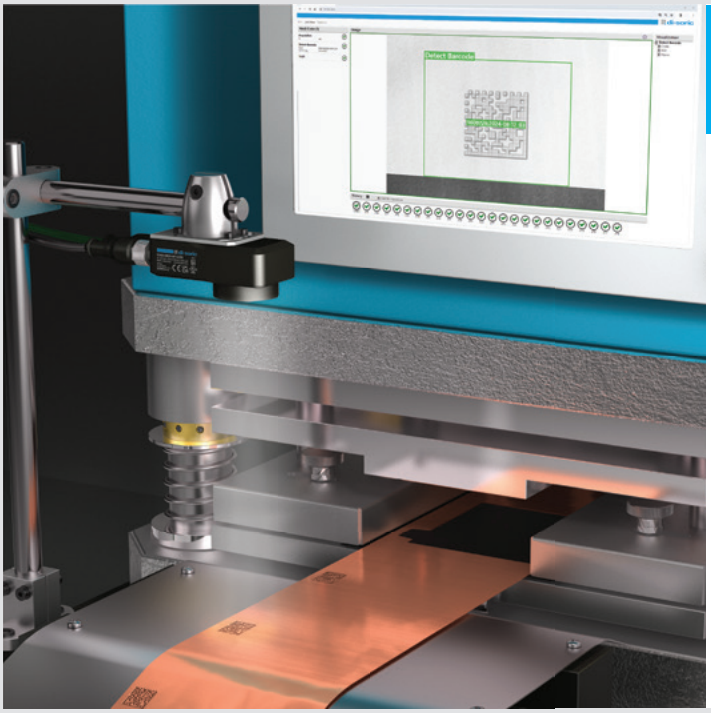
Simple adjustment enables fast commissioning, while high performance ensures that electrodes can be produced quickly and reliably.



Position of electrolyte coating

During continuous coating of the electrolyte, a CS60-BM38-EP15/300 monitors its position on the copper foil. To ensure high accuracy, the image section kept is very small thanks to the interchangeable lenses. The CS60 detects any movement of the electrolyte and corrects the coating position accordingly. With the free running option of the CS60, endless material can also be tested.

Vision sensor
CS-60



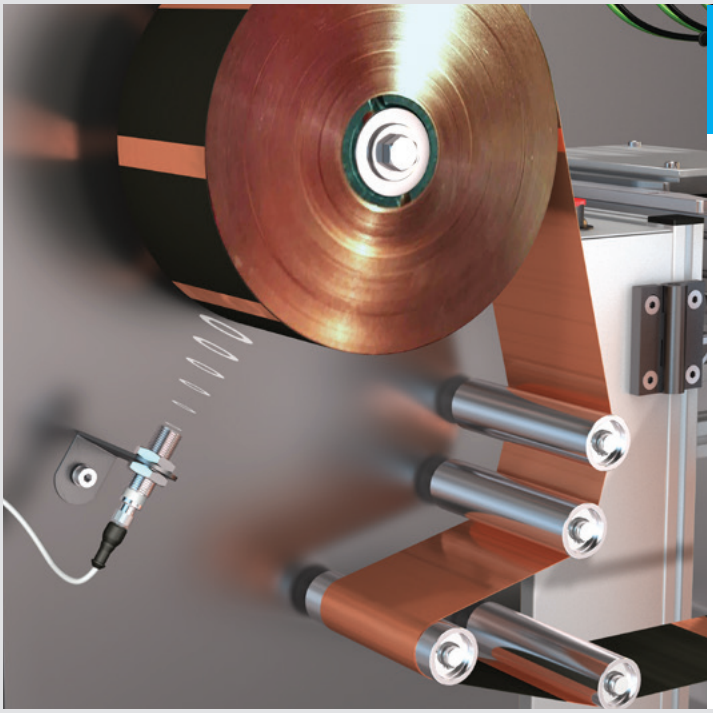
Continuous electrode identification

Traceability reduces the rejection rate associated with battery cell production. To do this, each electrode is marked with a laser-engraved DMC on the copper side. With its interchangeable lenses, our ID600 fixed-mounted reader can be adapted to the required setup and, thanks to the ID-Pro upgrade license, can also reliably read directly marked codes, even when the background is difficult.

Fixed-mounted ID readers
ID-600

CELL PRODUCTION

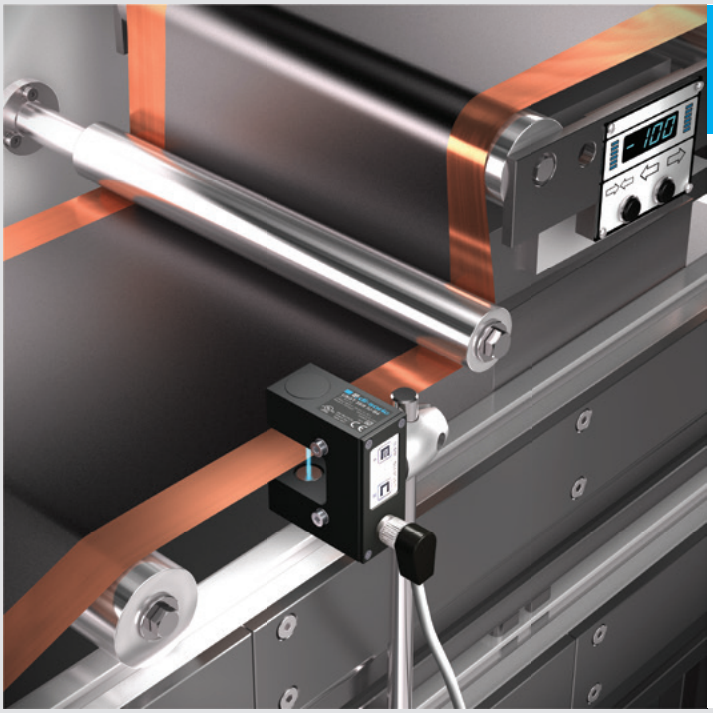
Battery cells with a high energy capacity, safety, and long service life are the keys to efficient electric mobility. During production, sensors, vision sensors and ID readers from di-soric are used. The products considerably increase productivity during the manufacturing of round cells and pouch cells.



Roller diameter check

When battery cells are assembled, the anodes, cathodes and separator foils are fed from a roll. Sensors from the US-M18 series measure the outer diameter of the foil material during this process. The speed of the roller can be continually adapted in the process with the determined measured value.

Ultrasonic sensor
US 18 M 800 IU-B4

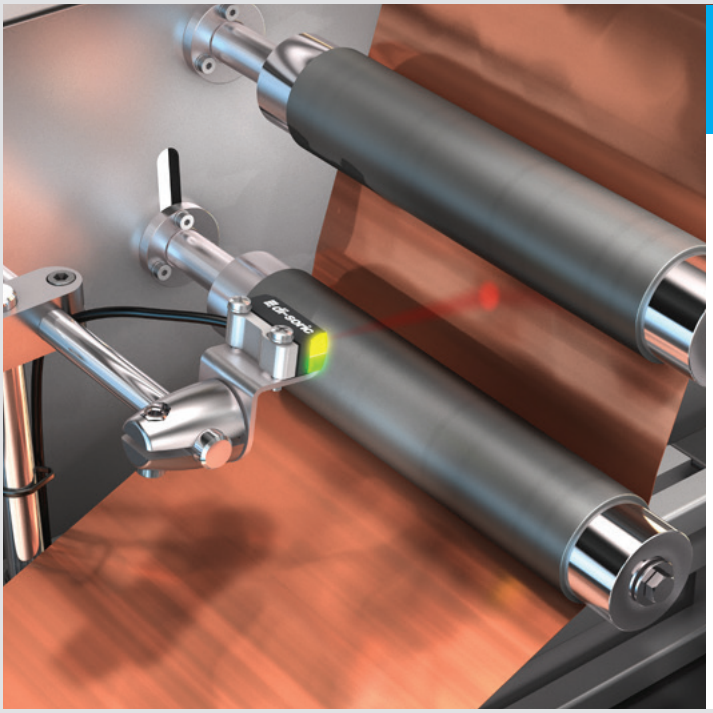


Web edge control

The foil material for battery cells is unwound from a roll in a winding machine and then processed. A USGT ultrasonic fork sensor determines the exact position of the web edge. The sensor has an analog output that transmits the position to the control unit. The sensor signal makes it possible to control the web edge.

Ultrasonic fork sensor
USGT 30/8 IU-B4

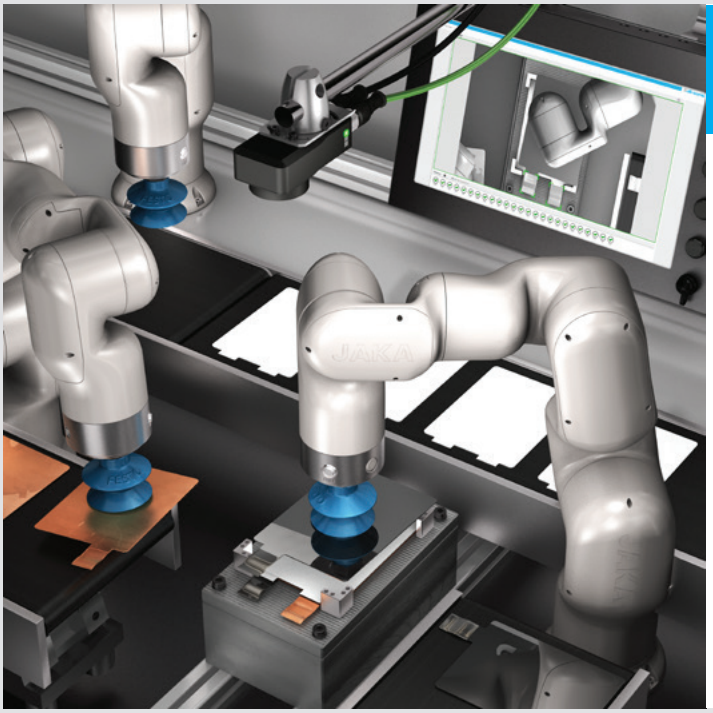
Simple adjustment enables fast commissioning, while the high performance ensures that the battery cells can be manufactured and tested reliably.



Tear monitoring

Foil material for battery cells is wound onto rolls and processed by winding machines at a high belt speed. If one of the foils tears, the machine must be stopped immediately. O-21 series compact diffuse reflective sensors with background suppression are used to detect a tape break. The sensors require just a little installation space and have a short response time.

Optical sensor
OH21-50PS-2C



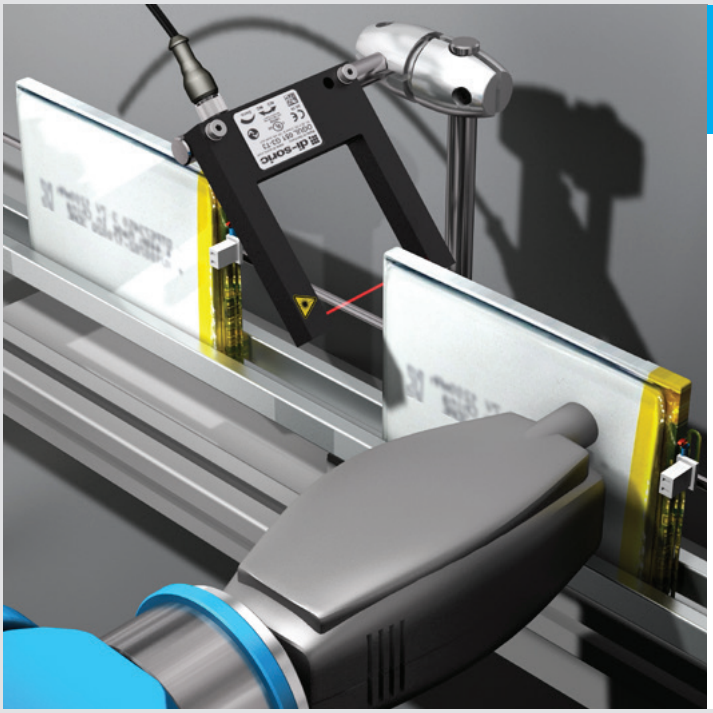
Pouch cell stacking

The CS60 vision sensor detects whether the electrode sheets are in the correct position during the stacking process. Thanks to the simple parameterization in nVision-i, the CS60 detects any misalignment or twisting and sends a correction factor to the robot so that it can align the electrodes or the separator.

Vision sensor
CS-60

MODULE PRODUCTION

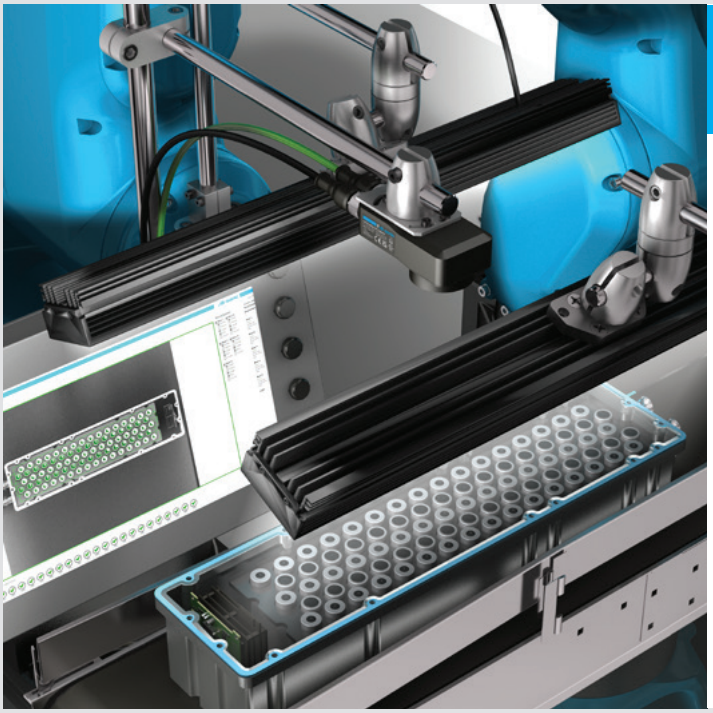
Highly automated manufacturing lines assemble the battery cells and housing with other components to create high-performance battery modules. During production, sensors, signal lights, vision sensors and ID readers from di-soric are used. The products considerably increase quality during coating, assembling, screwing, affixing and joining.



Battery cell positioning

In a testing machine, the pouch battery cells are fed by a conveyor line. These cells must be positioned in the test station with absolute precision. To check the position, a laser fork light barrier from the OGUL series comes into play. The small laser light spot of the sensors makes it possible to monitor the position of the modules precisely.
Fork light barriers are ready to install and immediately ready for operation; no complex mechanical adjustment is required.

Fork light barrier
OGUL 051 G3-T3

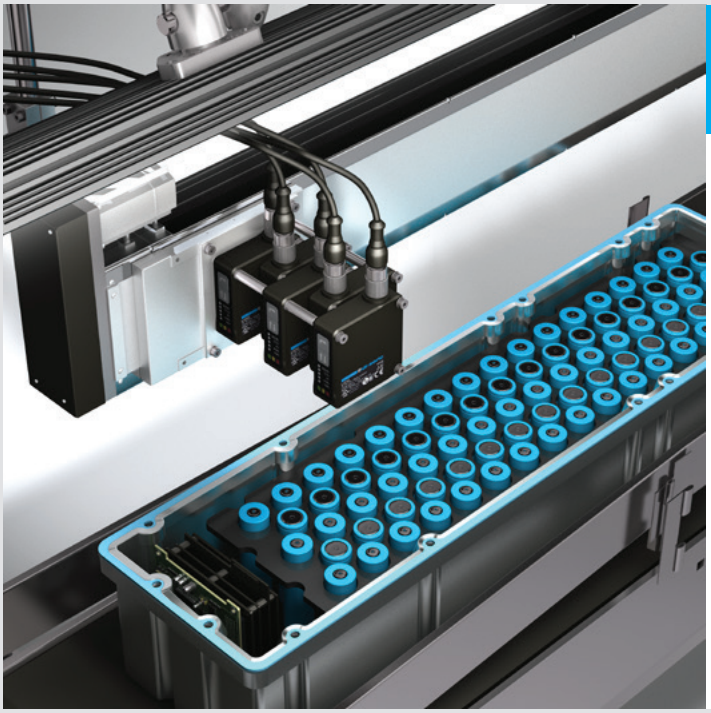


Round cell positioning

For a battery module to function correctly, the cells must be placed in the module exactly in accordance with a defined plug-in pattern. The decisive factor is the position of the poles: The negative and positive poles have different diameters, so the plug-in pattern can be checked by looking at the circular surfaces. Two barlights (BEK-A500-G5T-K-BS) are used to illuminate the entire area evenly. After each cell is placed, its status is checked so that the gripper can still correct the position if it is misaligned, thereby minimizing the need for rework.

Vision sensor
CS-60

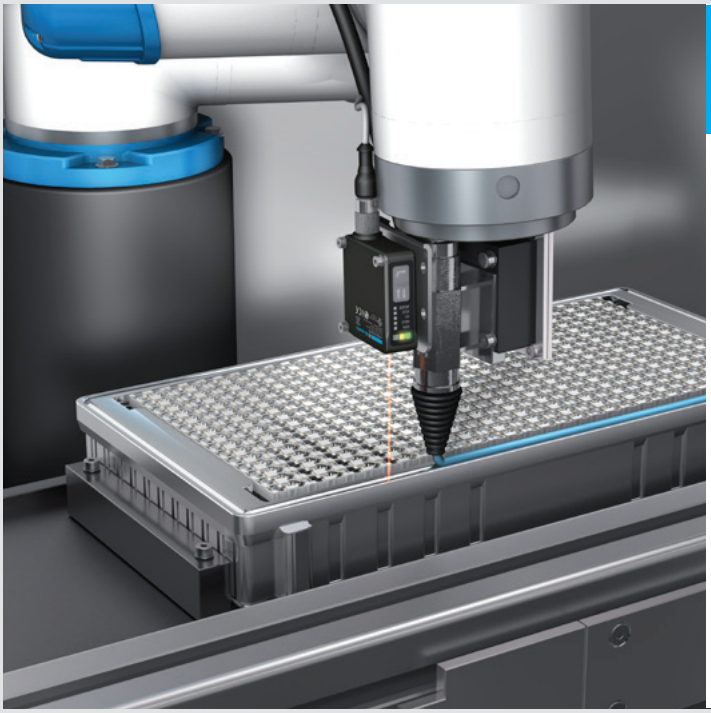
Simple adjustment enables fast commissioning, while the high performance ensures that the battery modules can be manufactured and tested reliably.



Height determination

Industrial robots place battery cells in the housing of a battery module fully automatically. For further processing, it is necessary to ensure that the modules are at the same height.
A LAT-52 series laser distance sensor determines the exact position of the modules in a 0.01 mm grid. The high-resolution variant LAT52-80IU-B5, with a measuring range starting at 30 mm, enables space-saving installation.

Optical distance sensor
LAT52-80IU-RB5



Distance regulation in the adhesion process

Robot-controlled adhesion and sealing of battery modules is extremely important. To ensure a high quality and shelf life, the distance of the glue nozzle from the object during application of the adhesive must always be optimal. Distance detection in the sub-mm range is performed with an optical distance sensor. Due to its compact design, the LAT-52 can be mounted close to the glue nozzle.

Optical distance sensor
LAT52-200IU-B5

Fill level of step feeder

In step feeders, the US Q12 M 400 XP G3-T4 ultrasonic sensor detects shiny parts such as nuts and bolts without any problems. A potentiometer is used to adjust the sensor intuitively. If the desired fill level fall is not reached, the sensor switches and material is refilled. The narrow sonic cone and the specific fill level evaluation for step feeders provide maximum operational reliability.

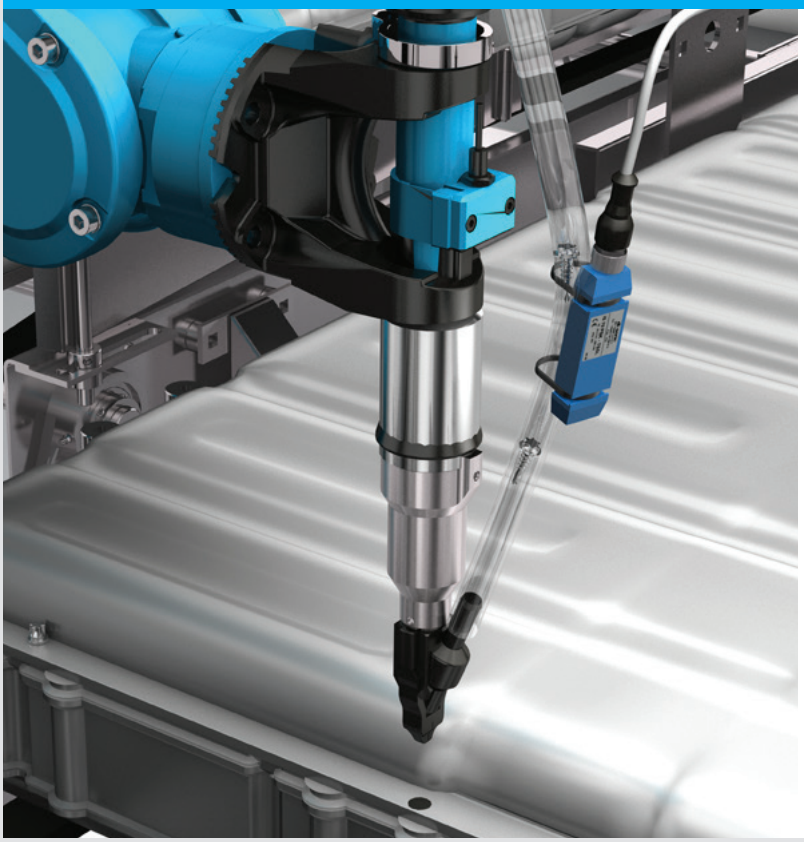
Ultrasonic sensor
US Q12 M 400 XP G3-

Optical visualization of fill levels

When several circular feeders are used, it is important to monitor the fill level of the screws. Easily visible SB-RGB signal lighting that operates in level mode allows operating personnel to see the fill level of the screws from a distance. This enables the workers to detect low fill levels early enough and refill the feeders. The continuous availability of material ensures efficiency in production and guarantees maximum output.

Signal lighting
SB-RGB-481-K-B5

Screw detection



Important components of battery modules are fastened with screw connections. Automated screw fastening involves feeding the screws through supply tubes. Inductive tube sensors from the IS series detect fast-moving screws. The compact sensors can be adapted to different tube cross-sections very easily and flexibly. Cable ties can be used to fasten them to tubes of different diameters.

Tube sensor
IS 70 PSK-TSSL

Code allocation of battery cells

A battery module consists of several cells that must be clearly allocated for traceability. To achieve this, data matrix codes are applied to the module housing and each cell. An ID-600 reads the codes of the cells, even though the large field of view and the small, directly marked codes are challenging. The powerful code algorithm reads directly marked codes reliably, even at low resolution. Several codes can be captured in one image, linked to the module code with the logic function in nVision-i and sent to the PLC. Interchangeable lenses allow the ID-600's field of view to be adjusted for different module sizes.

Fixed-mounted ID readers
ID-600

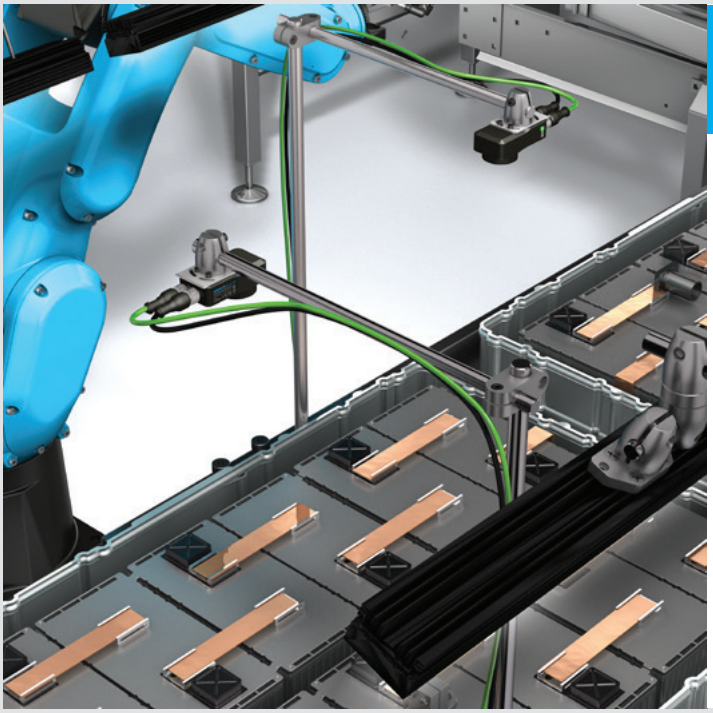
PACK PRODUCTION

During the production of battery packs, several battery modules and the battery management system are assembled in the final housing. During production, sensors, signal lights, vision sensors and ID readers from di-soric are used.

Screw detection

Battery modules are screwed into the housing of a battery pack by robots. For detecting screws in screwdriving robots, inductive ring sensors are the best solution. Sensors from the IRSD series are extremely reliable and mechanically robust. The sensors are equipped with an IO-Link interface for configuration and diagnostics. The IO-Link diagnosis helps coordinate service cycles and enables the use of remote maintenance in production systems.

Inductive ring sensor
IRSD-15-G3-B4

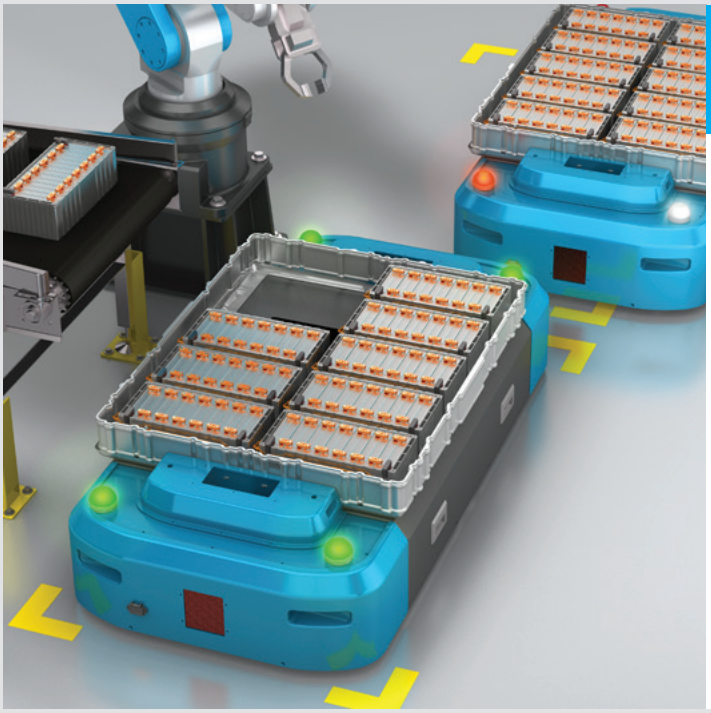


Completeness and position monitoring

The individual battery modules are inserted into the battery pack. Before the internal connections are made, the pack is checked again to ensure that all the modules are present and in the correct position. To do this, the CS60 checks the predefined position of the contact points and the presence of all battery modules. If necessary, the CS60 can also read the directly marked codes on the top of the modules.

Vision sensor
CS-60

The products considerably increase productivity during the final assembly. Simple adjustment enables fast commissioning, while the high performance ensures that the final assembly process for making a ready-to-install battery unit is economical and reliable.

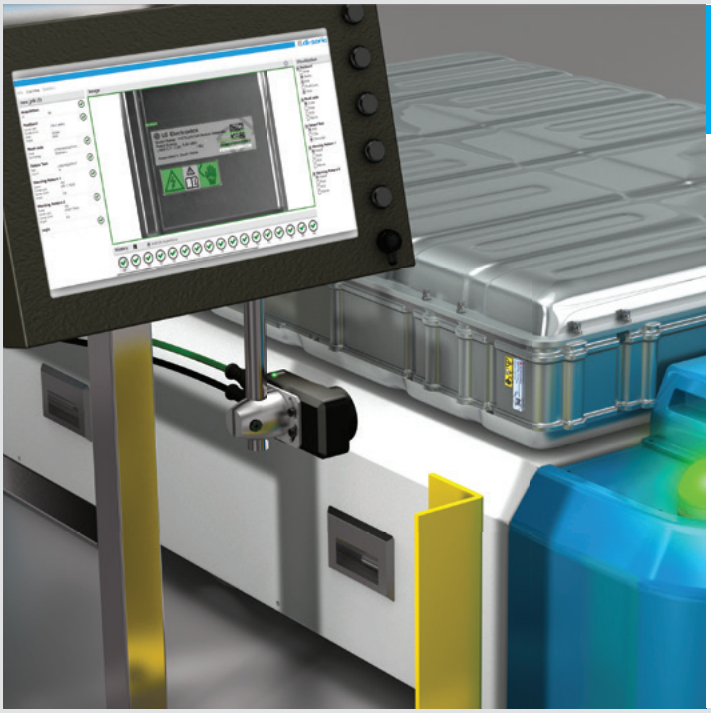


Signal lights of automated guided vehicles (AGV)

In production, the heavy battery packs are transported to the individual assembly steps on AGVs.

The red SBP-RGB signal light on the AGV alerts workers when the vehicle is moving off to the side. During the manufacturing process, the battery packs are mechanically secured to the AGV, and robots do the processing. A green SBP-RGB indicates that the machine process is working properly.

Signal light
SBP-RGB-R50D-B5



Final inspection of labels and safety symbols

Code reading and an OCR license help read the label's content and compare it with plain text. In addition, pattern recognition checks the safety symbols so that no battery pack is delivered with faulty labels.

Vision sensor
CS-60

SOLUTIONS. CLEVER. PRACTICAL.

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