

BALLUFF



B *innovating automation*

**QUALITY AND RELIABILITY
FOR THE MOBILITY OF THE
FUTURE**

Battery industry

Balluff in battery production

WE MOVE THE AUTOMOTIVE INDUSTRY FORWARD



Balluff in the battery industry

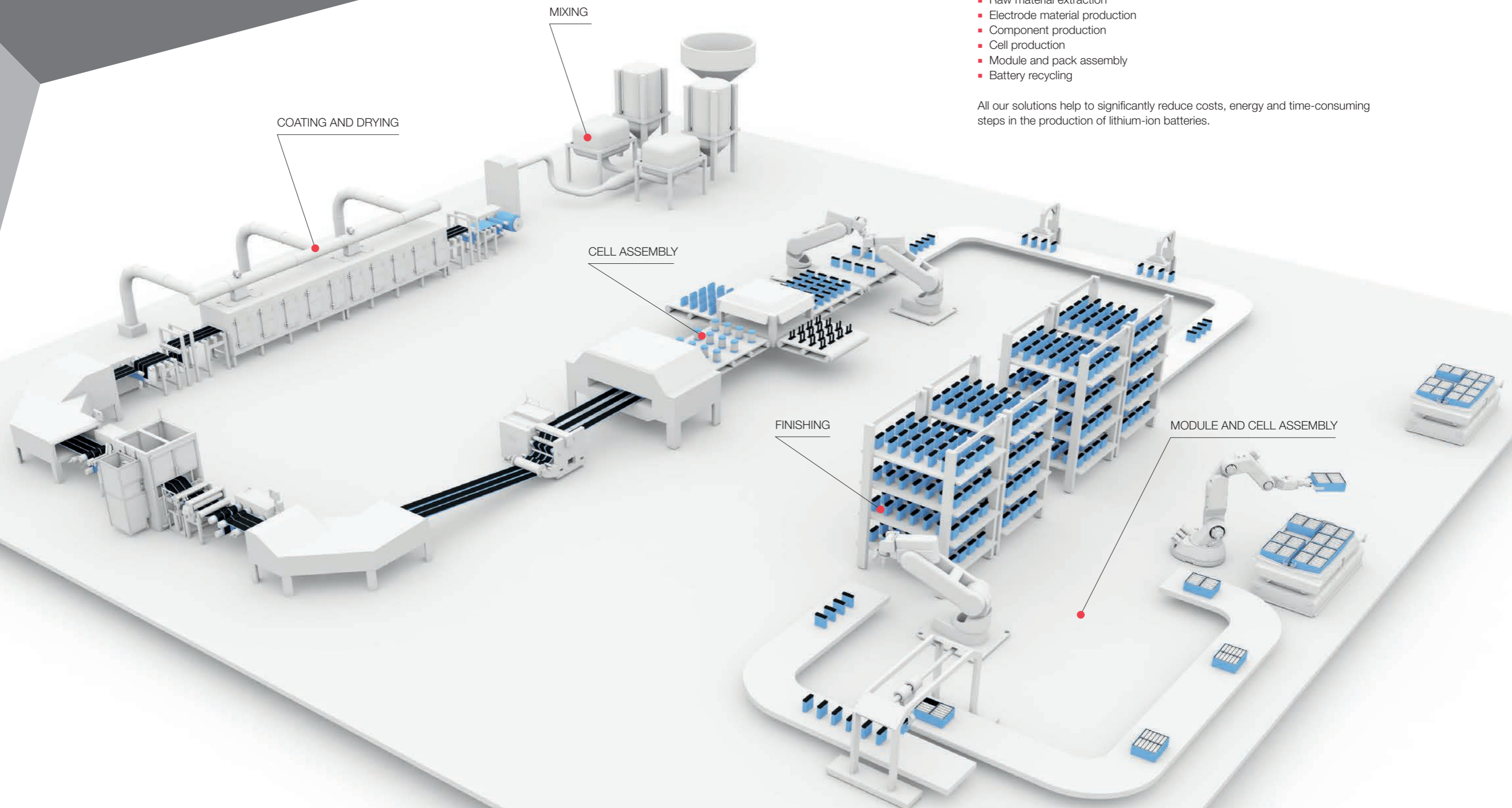
SOLUTIONS FOR AUTOMATED BATTERY PRODUCTION

Due to the strong growth of electromobility and the increasing demand for energy storage systems, the importance of lithium-ion batteries continues to grow. This makes batteries the key technology for electric vehicles and the core competence of vehicle manufacturers and suppliers. The future of the vehicle industry is increasingly in the hands of the battery industry.

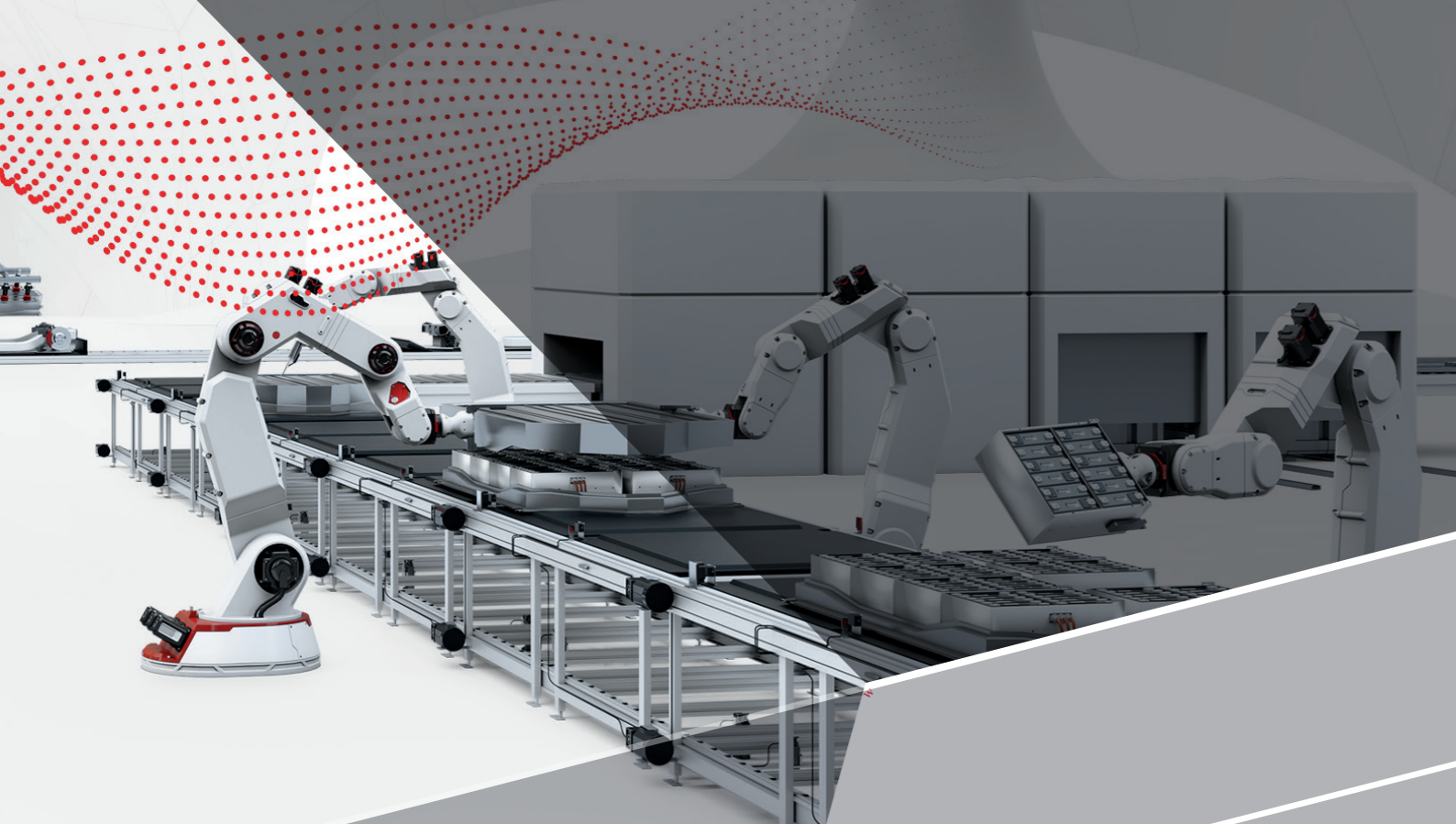
Balluff solutions are used in all essential production steps of the battery industry:

- Raw material extraction
- Electrode material production
- Component production
- Cell production
- Module and pack assembly
- Battery recycling

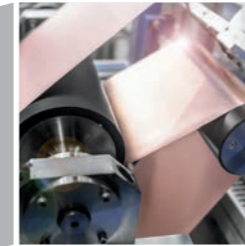
All our solutions help to significantly reduce costs, energy and time-consuming steps in the production of lithium-ion batteries.



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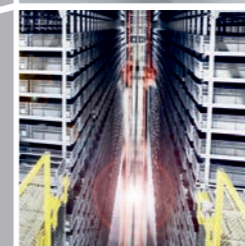


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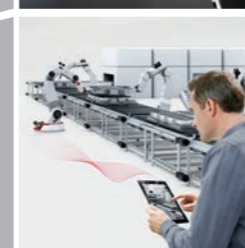
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ABOUT BALLUFF 66

Electrode Production

QUALITY ASSURANCE FROM THE VERY BEGINNING

 *innovating automation*

The first step in battery manufacturing is the production of the positive and negative electrodes. In addition to the mixing of slurry, the main processes also include coating, drying, calendaring, slitting and vacuum drying. In all these production steps, various parameters and quality characteristics must be reliably maintained. These include, for example, the filling level of the raw materials, the temperature and pressure of the electrode slurry in pipes and tanks, a proper layer thickness, the cleanliness of the electrodes, and the correct positioning and labeling of the parent and daughter rolls.

We help you meet these stringent requirements with a wide range of optical sensors in various roll-to-roll processes. In addition, our position measurement systems control the movements of your calender rolls for optimal pressure, and traceability solutions enable the identification of electrode coils.

Mixing



RELIABLY DETECT FILL LEVELS BCS capacitive sensors and BGL fork sensors

To ensure that storage tanks and containers for raw materials and electrolytes are filled with the required quantities, Balluff offers a wide range of sensors for level detection. Reliably detect levels through non-metallic containers and require no adjustment for conductive media and container wall thicknesses up to 10 mm. Versions with the IO-Link interface offer you extended application and adjustment options. The sensor is easy to install using an industry-standard 3-wire cable. Process monitoring, configuration and error analysis of the IO-Link sensors are carried out in the control system. This accelerates machine sequences and makes operation significantly more efficient.

Features

- Detection of fill levels through non-metallic container walls of up to 10 mm
- For highly conductive media such as acids and alkalis
- Compensation of foam and residues through Smart Level technology.
- Operating Modes: Standard I/O mode (SIO), IO-Link mode

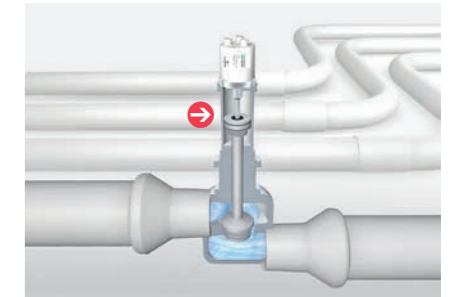


CONTINUOUSLY MONITOR PRODUCTION STEPS BNI SmartLight

Cathode and anode active materials are stored in tanks before they enter the mixer. If you need a complete visualization of the process in your production line, the signal light SmartLight offers the perfect solution. The SmartLight displays trends and tendencies so you can continuously monitor different production steps. The different modes – running light, level, segment and flexi mode – can be set without mechanical changes. With appropriate programming, you can choose between run light and color gradient or the display of up to five color segments.

Features

- Extremely flexible: can be changed during operation without mechanical reconfiguration
- Easy to install and retrofit anywhere
- Multicolor, bright LEDs with wide color spectrum, individually definable
- With IO-Link for ideal use in IIoT

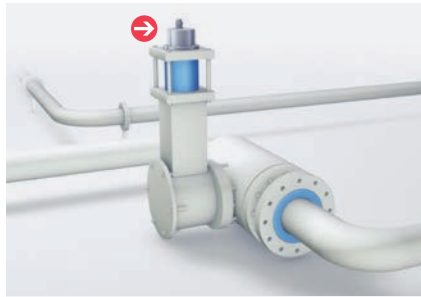


FAIL-SAFE POSITION MEASUREMENT BTL redundant magnetostrictive position measuring systems

The industrial production of lithium-ion batteries requires fast-reacting control and dosing valves in electrode production to ensure the quality of the electrode slurry and is subject to the highest requirements, which can often only be met by a redundant system. Our BTL 7 magnetostrictive linear position sensor combines up to three independent measuring paths and three independent electronic systems in one rod. The robust, non-contact and absolute position measuring system is freely configurable.

Features

- Two or three completely separate systems in one housing for highest reliability
- Measuring range of up to 7620 mm: also suitable for large valves
- Compact, space-saving housing
- Fast commissioning
- Non-contact and wear free
- Monitoring of all channels via LEDs

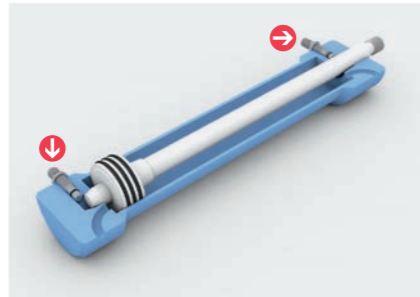


RELIABLE POSITION FEEDBACK
BTL ATEX magnetostrictive linear position sensors

Many applications in hazardous areas require the use of position measuring systems for reliable position feedback. One example is the use of isolation and control valves in slurry processing.

Features

- IECEx, ATEX, NEC and many other international certifications
- Approvals for zones 0 (1G), 1 (2G), 2 (3G), as well as 20 (1D), 21 (2D) and 22 (3D)
- Measuring ranges up to 7620 mm
- Absolute output signal with resolution up to 5 µm
- Pressure-rated up to 600 bar
- Variety of interfaces available
- Space-saving due to short housing
- Fast commissioning due to characteristic curve setting



RELIABLE POSITION DETECTION IN HAZARDOUS AREAS
BES and BHS inductive sensors

Balluff offers a broad portfolio of inductive sensors for positioning and object detection in active material preparation and slurry mixing, which are at least partially hazardous areas. For end position monitoring on hydraulic cylinders and for the monitoring of valve positions, you can also choose from a wide range of pressure-rated resistant sensors.

Features

- Approvals for zones 0 (1G), 1 (2G), 2 (3G), as well as 20 (1D), 21 (2D) and 22 (3D)
- Pressure-rated up to 500 bar
- Resistant to high temperatures up to 140 °C
- Non-contact and wear-free
- Insensitive to contamination
- Short-circuit-proof
- Wide range of common sensor housings
- Safe unit due to the use of available isolating amplifiers and cable variants
- Variants for use in zones 0 and 20 without isolating amplifier



TEMPERATURE AND PRESSURE MONITORING IN PIPING SYSTEMS
BSP pressure sensors and BFT temperature sensors

In the continuous production of electrode slurries for large-scale lithium-ion battery manufacturing, the slurry is pumped into tanks and made available for coating. To maintain the correct temperature and pressure in the pipe systems and tanks, continuous monitoring is required. Our pressure sensors with or without display and our temperature sensors are ideal for this application.

Features

- Version with rotatable, easy-to-read display available
- Versions without display: compact form factor and high vibration resistance
- Interfaces: IO-Link, analog signals and setpoints
- Robust M12 connector for easy integration
- UL and CE approval



OPTIMIZE PROCESSES FOR SLURRY MIXING
IO-Link

By modifying the mixing technology, you can reduce costs while maintaining quality, save energy and improve throughput. Electrode performance is also highly dependent on mixing conditions and operation. Monitoring and adjusting the temperature and pressure within the production loop based on an IO-Link architecture guarantees the correct viscosity of the slurry and thus the best performance of your cell production equipment. IO-Link supports easy and cost-effective conversion from analog to digital signals to improve plant efficiency.

Features

- IO-Link for analog signals, process visualization, pressure and temperature sensors
- Analog hub for cost-efficient signal conversion
- SmartLight visualization of process setpoint and actual values
- Monitoring of filling levels



AUTOMATED TRACKING OF ACTIVE MATERIALS
BIS U industrial RFID systems

The active materials of a battery are the chemically active components of the anode and cathode of a cell and the electrolyte between them. The electrode paste is made from various materials that are transported to the mixing area in containers for slurry mixing. The identification of the raw materials and the slurry containers is realized cost-effectively and automatically by means of a BIS U RFID chip. All relevant data such as production ID or material ID are stored on the tag and can be read either with a handheld reader or a permanently installed system.

Features

- Easy integration via globally used standard interfaces
- Global standard ISO 18000-6C and EPC Gen2 Class1
- Flexible use thanks to a wide range of possible combinations of data carriers and antennas
- Ranges of up to 6 m
- Pulse capability for simultaneous acquisition of many data carriers (tags)
- Suitable for connection to conventional control systems via bus interfaces and higher-level IT systems
- Complete customized system solutions can be realized
- Wide range of accessories available for easy integration into various applications



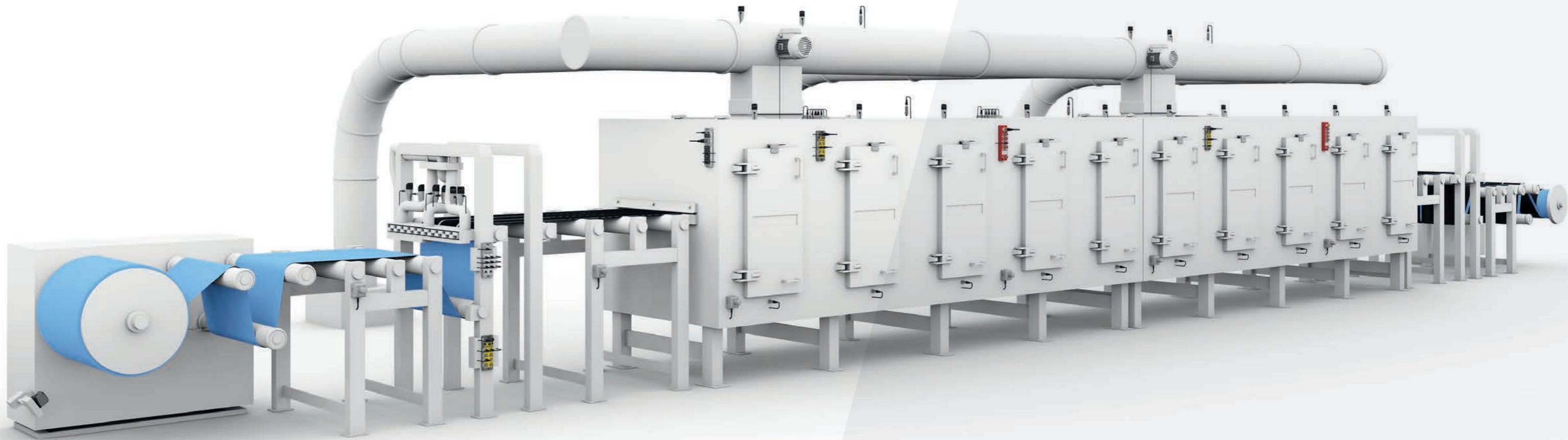
MONITORING MIXER CONDITION
BCM Condition Monitoring Sensors

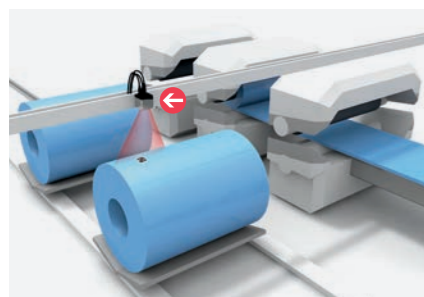
Condition monitoring sensors from Balluff provide you with condition data of your mixer or other battery production equipment, so that you are informed of potential problems at an early stage. Physical parameters such as vibration or temperature are recorded directly on the motor and passed on to a higher-level system via IO-Link. If individually defined limit values are reached, an alarm is triggered. The sensors also monitor their own status. All this helps you avoid unplanned, cost-intensive shutdowns and manual inspections.

Features

- Suitable for confined spaces due to compact design
- Convenient parameterization via IO-Link
- Multiple measured variables in one device: vibration, temperature, humidity, ambient pressure
- Integrated evaluation electronics with configurable data pre-processing
- Flexible process data design

Coating and drying



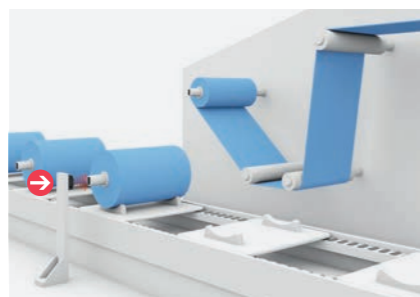


ELECTRODE COIL IDENTIFICATION
BVS handheld code reader and Ident sensor

Copper and aluminum foils are identified and recorded before they are unrolled in order to keep the material usage in the production process transparent. We offer a wide range of identification solutions for this purpose – regardless of whether you use barcodes, data matrix codes or QR codes to mark your foils. Our portfolio for automatic code reading ranges from manual handheld scanners to stationary code readers.

Features

- Compact design
- Easy integration into your production
- Secure reading of multiple codes at the same time possible

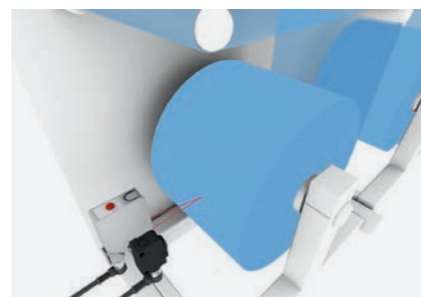


ELECTRODE COIL IDENTIFICATION
BIS industrial RFID systems

Our wide range of solutions in the field of RFID also helps you to avoid the use of wrong or old carrier foils for the coating process. Here we offer you hardware in different frequency ranges. For example, our versatile UHF read/write heads are suitable for longer ranges and automatic detection of several coils simultaneously. But we also offer RFID devices in the HF and LF range.

Features

- Large reading ranges
- Continuous documentation of process steps in real time
- Automatic recognition without manual scanning processes
- Complete transparency of material usage



MONITOR MATERIAL AVAILABILITY
BOD optoelectronic distance sensors and BUS ultrasonic sensors

To ensure there is always enough material available for the coating process, both our optical distance sensors and ultrasonic sensors can be used to monitor how much carrier film is still on the roll. This allows you to replace coils at an early stage and avoid having to interrupt the coating process. Thanks to their IO-Link interface, the sensors can also be easily commissioned and flexibly adapted to your application.

Features

- Extensive additional functions and parameterization options through IO-Link
- Display for visualization of setting functions
- Visible laser for easy alignment

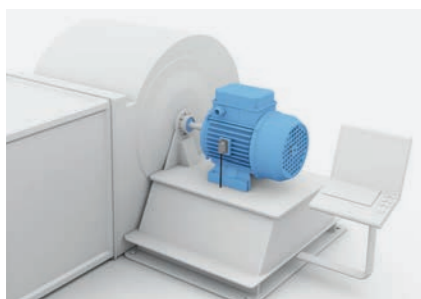


TRANSMITTING ANALOG PROCESS DATA TO THE CONTROLLER
BNI network modules and IO-Link master

Both pressure and temperature sensors ensure quality control of your coating process. To enable flexible, fast and efficient communication from the sensors to the PLC, and thus exploit their full potential, our network modules and IO-Link masters are the ideal solution.

Features

- Simple setup and intuitive operation
- Standardized interfaces
- Robust and suitable for industrial use



**CONDITION MONITORING
OF EXHAUST FANS
CMTK Condition Monitoring Toolkit**

After coating, the copper and aluminum foils go through the drying process. The condition of the fan is critical here, as thermal processes require a long preheating time for a restart. A shutdown is expensive and reduces OEE. Our condition monitoring toolkit (cmtk) – consisting of the base unit with integrated software and interfaces for up to four IO-Link sensors as well as connection options for IO-Link masters or hubs – not only checks the condition of the fan, but also indirectly the correct condition of the service doors.

Features

- Uniform retrofit solution for machine and process monitoring
- High flexibility due to the connection of up to four IO-Link sensors
- Plug-and-play commissioning of the system and visualization of the data
- Output of warning messages when adjustable limit values are exceeded
- Autonomous system with data storage, independent of cloud and machine control system
- Remote monitoring from any location thanks to network integration



**TRANSFER DATA EASILY
AND COST-EFFECTIVELY
BNI IO-Link masters, hubs and signal
converters**

The production of lithium-ion batteries is extremely complex and requires many parameters. This is especially true in the drying process which affects the properties of the electrodes and influences the final performance of the cells. That's why the various sections of the dryer must be continuously monitored, regardless of the drying method. Our IO-Link hubs and signal converters support you in this. They offer significant cost reduction potential for plants with limited analog value. Instead of expensive shielded cables, you can simply use unshielded three-wire cables. The signal neutrality of the IO-Link master modules in combination with the IO-Link hubs and converters offers you maximum variance compatibility of the signals.

Features

- Conversion of analog input/output signals to IO-Link
- Voltage/current, Pt-sensor or thermocouple configurable
- Different current/voltage interfaces available (0...10 V, 5...10 V, -10...+10 V, 0...5 V, -5...+5 V, 0...20 mA, 4...20 mA)
- Configurable resolution (10...16 bit)
- High protection class for harsh conditions



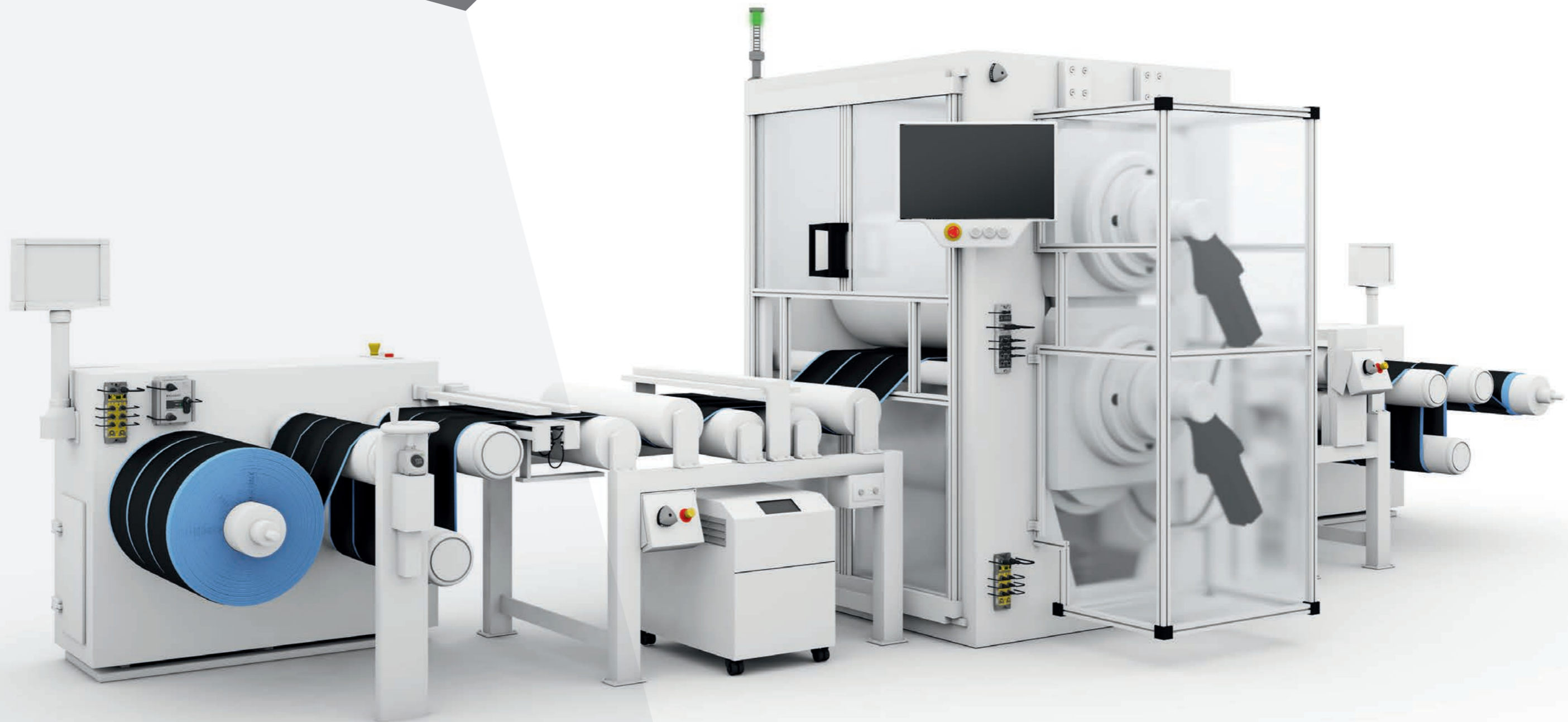
**INTEGRATE, DETECT AND CONTROL
SAFETY COMPONENTS
BNI safety I/O modules**

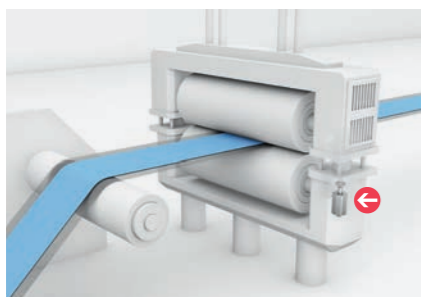
Automated cell production needs safety and reliability. To ensure this for equipment and operators, Balluff offers a comprehensive safe networking portfolio that includes safety solutions for IO-Link and our new CIP Safety I/O module. The module is a reliable solution for safe connection your sensors and actuators to industrial controllers – even in harsh environments with influences such as dust, vibration or liquid. It communicates with safety components via EtherNet/IP using the CIP Safety protocol. Thanks to its IP67-certified housing, you can mount the module directly on the machine.

Features

- Integration, detection and control of safety components in safe applications up to SIL3, CAT4/PIe
- TÜV and ODVA certified
- Reliable processing of safe application data
- Connection of single and dual channel safety devices possible
- Space-saving mounting on the machine
- IP67 protection class
- Self-monitoring and diagnostic LEDs

Calendering



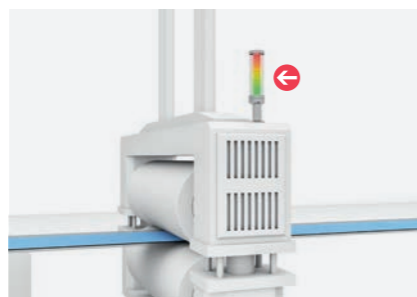


CALENDER ROLL POSITIONING
BTL magnetostrictive position
measuring systems

To compact the coated copper or aluminum foils, the movements of the calender rolls must be precise. Balluff position measuring systems control these movements in the hydraulic cylinders of your calender, ensuring optimum and constant line pressure. The substrate material is not squeezed and you achieve an even surface structure as well as the desired material porosity.

Features

- Available in very small designs
- Easy installation
- Insensitive to shock, vibration and contamination
- Various interfaces available

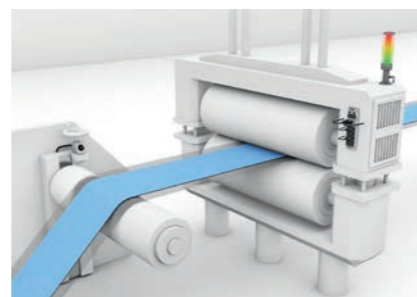


VISUALIZE CALENDER PROCESSES
BNI SmartLight

With our SmartLight LED signal tower, you can keep an eye on the status of your calendaring process at all times. With a rich color spectrum and the ability to program individual configurable segments, it can immediately display critical machine and system conditions. You detect malfunctions at an early stage and initiate corrective measures in good time – for efficient plant operation.

Features

- Individually definable color spectrum
- Three different configurable modes
- Display can be changed during operation without mechanical conversion
- Optionally available with integrated sound module for acoustic indications



AUTOMATE FORMAT CHANGEOVER
Guided changeover solution

To ensure the physical properties of the electrode and to increase the bonding strength between electrode and current collector, the coating thickness and the tensioning of the film must be adjusted. Automated format changeover not only makes your lines more flexible and productive, but also avoids errors. Now even smaller batches can be processed efficiently and thus more economically. Balluff offers a variety of position measuring systems tailored to your particular application, requirements and ambient conditions.

Features

- Short set-up times and increased system productivity
- Optimized planning with simultaneous reduction of downtimes
- Increased process reliability through format monitoring
- Greater flexibility in electrode sizes and shapes

Cutting

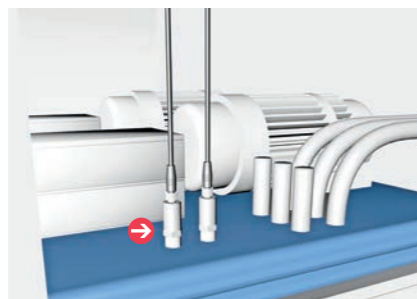


SECURE IDENTIFICATION AND PREDICTIVE MAINTENANCE OF TOOLS BIS U industrial RFID systems

With our UHF data carriers, the operating times of all slitting blades can be documented directly on the tool. If a part needs to be cleaned, replaced or reworked, a message or alarm is sent to the machine control system before harmful conditions can occur. RFID data carriers can also be used to log regular cleaning cycles. You can use either a handheld RFID reader or a permanently installed reader.

Features

- Large reading ranges
- Complete documentation of mold use
- Complete transparency on usage, maintenance and rework

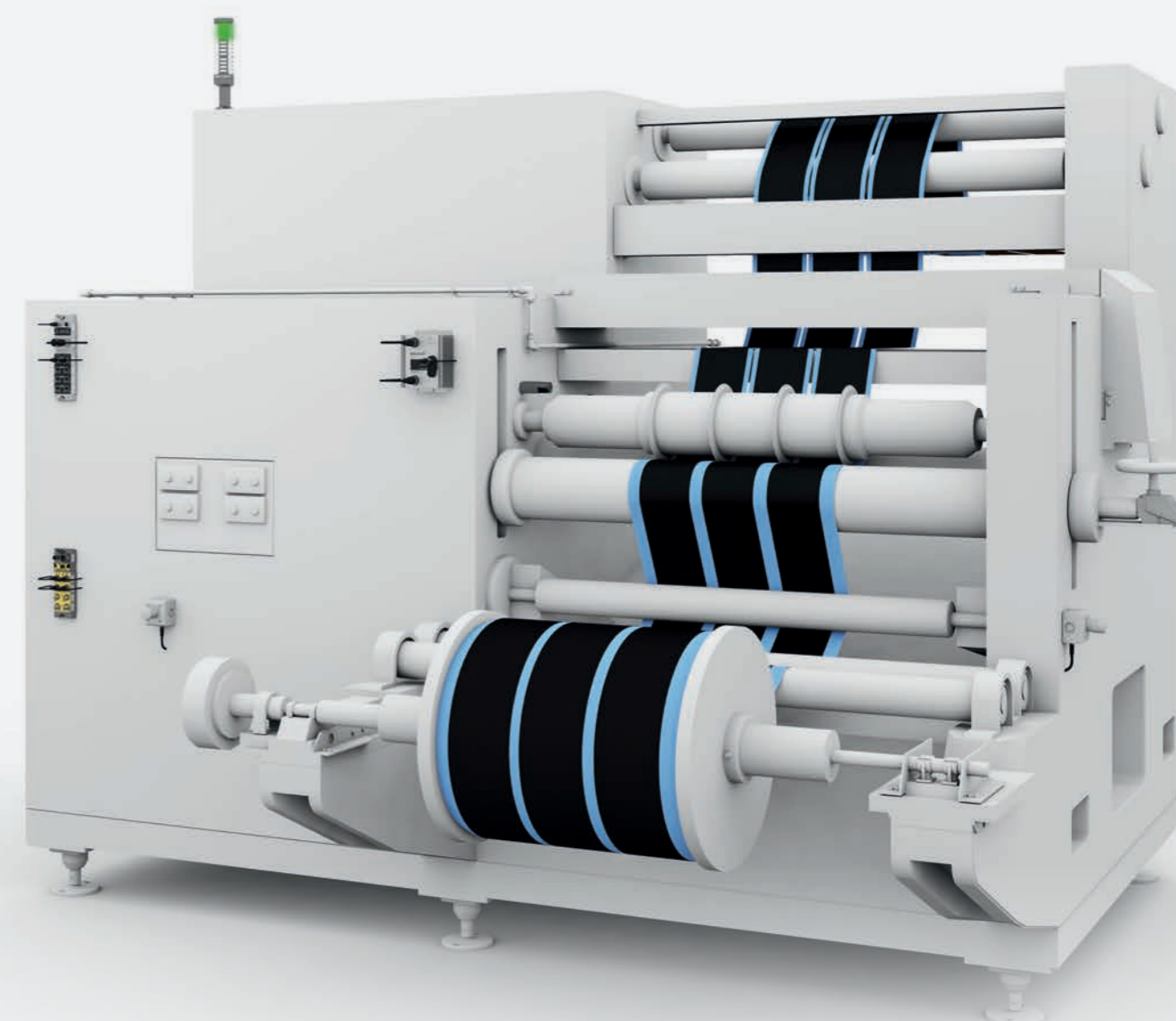


MEASURING AND TRANSMITTING PRESSURE DURING VACUUM DRYING BSP pressure transmitter with IO-Link interface

After calendering and cutting, the daughter rolls must pass through the vacuum drying process. In today's drying technology, the electrodes are usually heated in a vacuum environment at 60 to 150 °C for more than 12 hours, optionally with inert gas supply. Compact pressure transmitters mean continuously reliable pressure measurement in vacuum drying systems. They save space and are installed directly at the point of operation. The IO-Link interface provides all information for the PLC and the diagnostic system. The SIO mode also turns the transmitter into a pressure switch with a freely selectable switching point.

Features

- Measuring range -1...600 bar
- Vacuum measurement
- Robust stainless steel housing
- Measuring cell made of ceramic or stainless steel
- Output as 4...20 mA, 0...10 V or IO-Link with switching output (NPN/PNP)
- Excellent price-performance ratio



Cell assembly

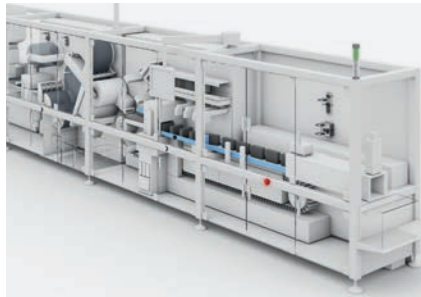
DIVERSE SOLUTIONS FOR DIVERSE PROCESSES

 *innovating automation*

Electrode production is followed by cell assembly, which is mainly carried out in clean room or dry room atmospheres and on highly automated machines. Depending on the cell type – cylindrical, prismatic or pouch – the main processes are stacking or winding, tab welding, insertion, electrolyte filling and sealing. Due to the high variance of the production processes, a wide range of automation equipment is required.

Balluff offers you a high-quality product range with enormous versatility for this purpose: sensors and systems for position measurement, identification, object detection, process media monitoring and a comprehensive portfolio for industrial image processing. In addition, there is network and connection technology for a powerful infrastructure as well as a wide range of compatible accessories. We develop comprehensive automation solutions and accompany you step by step into the digital industrial world.



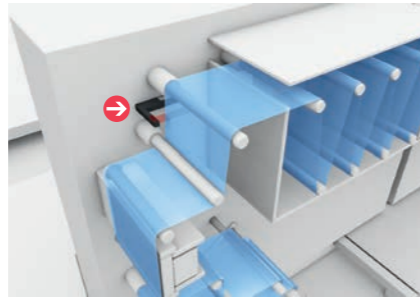


SIMPLIFY WIRING AND REDUCE COSTS
BNI IO-Link master and I/O module,
BAE power supply

Distributed I/O systems using machine-mounted network blocks (outside the control cabinet) eliminate or significantly reduce individual wire connections by using quick-connected cord-sets. Network blocks provide more status and diagnostic information to speed planning, design and commissioning. One drawback to this approach is that it requires a higher number of network nodes. With machine-mounted IO-Link masters, on the other hand, each port offers the ability to add up to 30 discrete I/O points, up to eight analog I/O points, or a single smart sensor, allowing the construction of a flexible, scalable control system architecture.

Features

- SmartLight for process visualization
- RFID antennas with IO-Link
- IO-Link sensors and conventional sensors
- Heartbeat power supply with IO-Link
- Balluff Engineering Tool software: central access for parameterization of all IO-Link devices, fast commissioning



CONTROLLING WEB EDGE IN
ROLL-TO-ROLL PROCESSES
BGL fork sensors

When aluminum and copper foils are fed through your lines on rolls for different process steps, it should be ensured that the material runs in a straight line. This avoids unwanted interruptions, e.g. during drying or calendering. Our fork sensors measure the web edge position of your films with micrometer precision, so that the guides of your system can be controlled accordingly.

Features

- Easy installation with only one electrical connection
- High resolution and repeatability due to particularly uniform light distribution
- Compact design for confined installation conditions (robust fork housing or narrow transmitter/receiver strips and remote electronics)

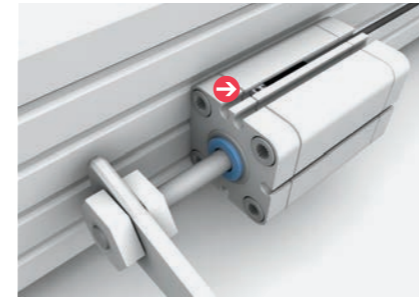


CONTINUOUS ROLL TRACKING
BSI inclination sensors

Tilt sensors from Balluff support you in ensuring the optimum tensile stress of your electrode foils. With a high accuracy of 0.1°, they measure the angle of the dancer arm so the material can always be fed optimally. The easy-to-mount sensors operate without contact and are therefore wear-free as well as maintenance-free.

Features

- Non-contact and absolute
- Measuring range up to 360°
- Direct inclination measurement without complex special construction



WEAR-FREE AND ACCURATE FEED-
BACK OF CYLINDER POSITION
BMF magnetic field sensor

Pneumatic cylinders are widely used in cell assembly. For wear-free and accurate position feedback, magnetic field sensors from Balluff can be securely attached to any of these pneumatic cylinders. Flush mountable, they are also suitable for space-critical applications, used from above even where slot ends are closed. Balluff also offers extremely short designs for short-stroke cylinders. The V-Twin version offers two sensors with a single connector. Significant savings in installation costs can be achieved with only one four-wire cable, less installation material and fewer terminations.

Features

- Quick installation, tight fit
- No contact burning, bouncing or sticking
- Only one switching point (with LED display)
- Applicable for cylinders and grippers with strong or weak magnets
- IP67: insensitive to dirt
- Suitable for ambient temperatures -25...+85 °C



CORRECT TENSIONING OF THE FOIL
DURING CELL ASSEMBLY
BMP magnetic field position
measurement systems

The web tension of electrode foils in roll-to-roll processes during several production steps is crucial to ensure high process reliability. Without the correct tension, web edge/guide control cannot function properly. For this purpose, our magnetic field position measuring systems reliably measure the stroke of the dancer cylinder during the up and down movement of the roll and transmit the signal to the control system. The compact design can be easily integrated and mounted on a wide range of cylinders.

Features

- Continuous monitoring of the piston position in a confined space with analog voltage and current output as well as IO-Link interface.
- Ideal for Industry 4.0 – automatic size change, condition monitoring and predictive maintenance
- Measuring range: up to 256 mm
- Reliable, accurate and repeatable absolute position feedback

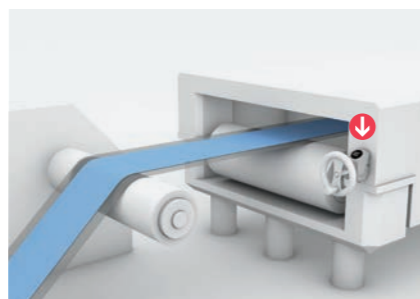


ENSURE PROCESS RELIABILITY
BLA light band

When conveying coated carrier foils, it is important to maintain an optimal distance between the rolls. Otherwise, the process could be blocked and, in the worst case, the machine could come to a standstill. Our compact light band reliably monitors the distance between rolls during calendaring, for example, to prevent this. Its IO-Link interface also enables central data storage and thus simple configuration – even in the event of format changes.

Features

- Simple parameterization via IO-Link
- Highly accurate position detection
- Simple size differentiation of diameters
- Quality check of gap dimensions
- Precise edge detection

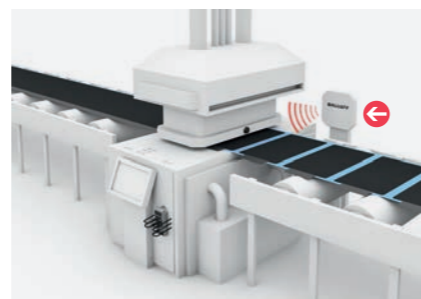


GUIDED ADJUSTMENT OF
ROLLER POSITION
BDG digital position indicator

Our digital position indicator with intuitive user interface supports you during your semi-automatic format changes when you need to quickly and reliably adjust the setting of the rolls and thus set your machines to different batch sizes. It shows you which setpoint must be reached. A running light guides you as you turn the wheel. In addition, the indicator offers you intelligent functions such as monitoring the internal temperature and relative humidity.

Features

- Extended IO-Link functionality for easy installation and data processing
- Integrated condition monitoring (e.g. indoor temperature, humidity)
- IP69K protection and ECOLAB-certified housing



RELIABLE IDENTIFICATION OF
PUNCHING TOOLS
BIS U industrial RFID systems

For the notching process of anode and cathode, the tools must be reliably identified before they enter the machine. This ensures that the correct tool is always used for the product variant being manufactured. With the help of our RFID system, which operates in the UHF range, you can automatically validate and monitor mold dies – at ranges of over one meter. The UHF processor has IO-Link enabled ports for peripheral sensor and actuator collection.

Features

- Processor units operate on multiple network protocols
- IO-Link interface

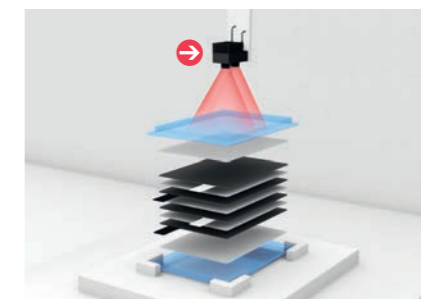


CONTINUOUS MEASUREMENT
OF NOTCHING TOOL POSITION
BTL magnetostrictive sensors

High-resolution micropulse transducers from Balluff for wear-free position measurement of notching tools are easy to install and have been proven for years. When the highest precision is required for position measurement in the tightest of spaces, we offer you a new generation of magnetostrictive sensors in two optimized profile designs and with analog as well as IO-Link interfaces.

Features

- Fast and easy mounting due to compact design
- Available with analog and IO-Link interface
- Easy parameterization via IO-Link
- Continuous monitoring of conditions such as temperature and service life for IO-Link-capable devices
- Simultaneous measurement of multiple positions and velocities
- Ideal for harsh industrial environments due to hermetically sealed IP67 aluminum housing
- Long service life, as wear-free due to non-contact operating principle

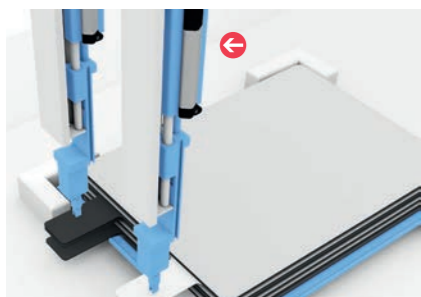


PRECISE POSITIONING OF
ELECTRODES AND SEPARATORS
DURING THE STACKING PROCESS
BVS 3D cameras

During the stacking process to produce the bi-cell, it is crucial that the active surfaces of the electrodes overlap. This makes the positioning accuracy of the anodes, cathodes and the separators in between a key quality criterion. With Balluff's smart 3D cameras for robotic applications, you can monitor the stacking process automatically and avoid quality defects caused by incorrect positioning. In addition, the increased level of automation keeps your cycle times low.

Features

- Fast implementation and easy operation thanks to user-friendly web-based user interface
- High flexibility thanks to optional software modules and GigE vision interface
- Low system costs and high system reliability thanks to on-board processing and application-specific software modules
- Higher productivity through smart software modules



PRECISE POSITIONING OF WELDING TOOLS
BMP magnetic field position measuring system

In ultrasonic welding of electrode tabs, our position measuring system helps you position your welding tool precisely to make this process reliable and ensure process quality. You monitor continuous work processes reliably and wear-free, maintain control over your processes and ensure the simultaneous processing of workpieces – in an energy-efficient manner.

Features

- Reliable results
- Application-relevant linearity and repeatability
- Modular concept for more flexibility
- Measuring range up to 256 mm
- High transparency
- Continuous checking of piston position in confined space with analog voltage and current output as well as IO-Link interface
- High process reliability
- Low temperature drift and high-quality electromagnetic compatibility
- Ideal for Industry 4.0
- Format change, condition monitoring and predictive maintenance



LEVEL DETECTION IN THE ELECTROLYTE FILLING PROCESS
BCS capacitive sensors, BUS ultrasonic sensors and BGL fork sensors

Electrolyte filling is a quality-critical and time-consuming process step. To avoid additional production costs due to increased process times, sufficient availability of the electrolyte must be guaranteed. Balluff offers a wide range of sensors for level detection for this purpose.

Features (depending on product type)

- Detection of levels through walls of non-metallic containers up to 10 mm thickness
- Suitable for highly conductive media such as acids and alkalis
- Compensation of foam and residues by Smart Level technology
- Operating modes: Standard I/O mode (SIO), IO-Link mode



WIRELESS COMMUNICATION WITH AGVs
IO-Link wireless

Transporting mother and daughter reels from one processing station to the next is the task of automated guided vehicles (AGVs). Until now, sensors and actuators as well as binary and/or analog devices have been integrated via cables. This is naturally a major problem for AGVs. IO-Link Wireless is a promising new standard for wireless communication in process and factory automation.

Features

- Easy configuration via integrated web server
- Frequency range 2.4...2.483 GHz can be used worldwide license-free
- Fast and reliable (latency 5 ms, error rate 10⁻⁹)
- Easily scalable and expandable by integrating additional devices (up to 120 devices)

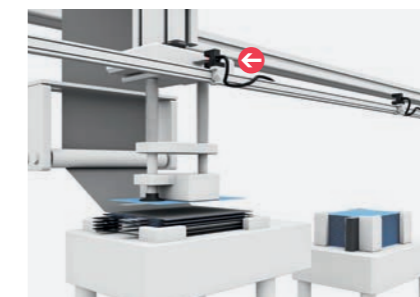


CONTROL DRIVERLESS TRANSPORT SYSTEMS
BIS industrial RFID systems

Reliable and automated transport of mother and daughter rolls as well as components such as cell housings is essential for industrial cell production. Our RFID systems facilitate the navigation of automated guided vehicles, enabling efficient material flow in battery production. Through communication between the RFID reader in the vehicle and the data carriers embedded in the floor, the vehicle is guided precisely to the respective work station by using its logic to detect the location and make decisions to stop, turn, rotate or drive straight ahead.

Features

- Detecting the absolute position as the vehicle passes by
- Can prove at any time which vehicle is where and with which material
- Communicate contact-free and maintenance-free
- Automate work processes, reduce manual activities



POSITIONING OF COMPONENTS IN CELL ASSEMBLY
BGL MiniSlot fork sensors

Cost-effective and precise positioning of moving parts is required in various production steps in cell assembly. Servo motors are used for positioning tools and fixtures. Our new MiniSlot fork sensors can be easily installed in space-critical automation applications for feedback of end positions and reference points, as their compact size requires less installation space than conventional photoelectric sensors. This reduces the effort and saves valuable time during commissioning and enables safe processes. Achieve the best results with our miniaturized MiniSlot fork sensors for precise positioning, reliable detection of fast motion sequences, small part detection in feed systems.

Features

- Six different designs for flexible use
- Cost-effective solution for space-critical applications
- Precise detection and high repeatability
- Status display with bright LED
- Uniform fork width: 5 mm
- Easy connection with 4-pin M8 standard plug, flat plug or cable

Cell finishing

SAFE FINISHING OF CELL PRODUCTION

 *innovating automation*

In the production of lithium-ion battery cells, the final steps are activation, aging, classification and final quality inspection. It is necessary to slowly charge and discharge, age and test each cell. During the aging process, the finished battery cells are stored for weeks to detect quality problems. Because of the large number of battery cells needed to produce electric cars, an industrial-scale facility is required for formation and testing. Manufacturers must store several hundred thousand cells in warehouses that must comply with expensive environmental requirements and safety precautions. Cell formation and finishing are the most complex, time-consuming and expensive processes, so cell finishing requires the highest equipment investment. With Balluff solutions, you can address the core challenges of safety, processing time and higher output without worry.



IDENTIFY AND TRACK CELL BOXES
BIS U industrial RFID systems

The identification of individual cell containers by reading RFID labels is already state of the art. These labels are also used to transport cells from assembly to finishing. By storing the required ID and quality data locally and tracking the pre-processes, the information can be assigned to all process steps. Our broad product portfolio with many different dimensions and designs offers you countless application possibilities.

Features

- For dynamic processes with large reading ranges
- Unique, unchangeable identification numbers (TID) and individually programmable EPCs (Electronic Product Code)
- Worldwide standards ISO 18000-6C or EPC Gen2 Class1
- Freely writable user memory area up to 112 bytes
- Some data carrier variants with additional password protection
- Mounting options: Gluing or screwing
- Variants for direct mounting on metal available
- Special temperature resistant tags up to 220 °C available

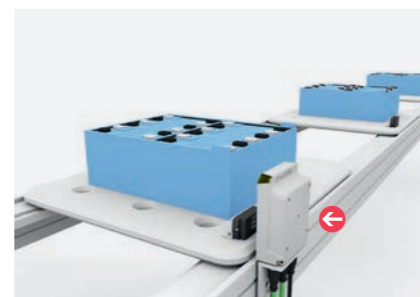


IDENTIFY PALLET AND TRACK CONTAINERS
BVS handheld code reader

Rely on our identification solutions for proper tracking of pallets, boxes and cell containers – and view all data relevant to intralogistics. The data is read by our vision sensors or with the help of our robust handheld barcode scanners.

Features

- Reliable reading confirmation by acoustic signal, 2 green LEDs and projection of a green LED spot onto the read code
- Intuitive target system with clearly visible laser marking frame
- Up to 30,000 reading cycles with one battery charge
- Installation-free operation thanks to low weight and ergonomic shape
- High-density versions available for high-resolution codes (up to 2.5 mil for 1D) and large areas (up to A4)
- Maximum reading ranges up to 110 cm

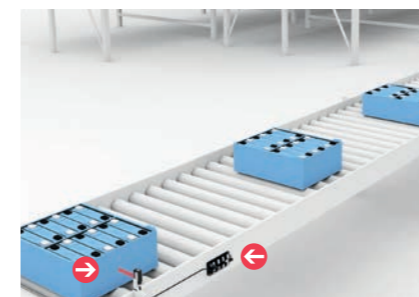


RELIABLY TRACK PALLET AND CONTAINERS
BIS M industrial RFID systems

For batch tracking of battery cells on conveyor lines, RFID labels are attached to pallets and containers to identify them throughout the finishing and intralogistics process or in automated storage and retrieval applications. RFID pallet tags are typically flat and unobtrusive, with many RFID tags able to operate in high temperature environments. Our BIS M RFID system is particularly fast and reliable – even with large amounts of data in assembly and production.

Features

- 4-pole standard wiring and IO-Link components
- Can be combined with passive data carriers with medium ranges up to 400 mm
- Seamless integration into applications through worldwide RFID standards ISO 15693 and ISO 14443A
- All worldwide common bus systems available
- Simple, fast commissioning
- High-speed components (up to eight times faster than ISO 15693)
- Wide range of accessories available for easy integration at all locations

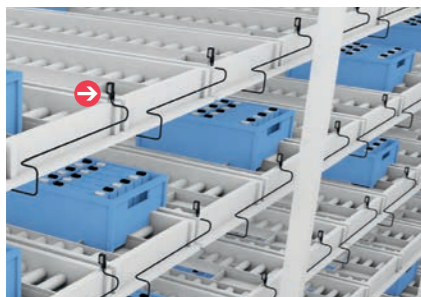


PRECISE OPTICAL DETECTION IN INTRALOGISTICS
BOS R81K photoelectric sensors and BNI IO-Link hub

Due to their design, Balluff optical sensors can also be used in confined installation situations, which is often the case with conveyor systems in formation and testing. With their precise switching behavior, they reliably detect the presence of cells, pallets or containers regardless of the surface material and over ranges. For simple and cost-effective installation, you can use complementary IP67 IO-Link hubs that connect 16 sensors to the controller via an IO-Link connection and are easily commissioned via plug-and-play.

Features

- Flexible use thanks to a wide range of mounting options
- Fast and easy alignment due to large diameter red light emitters
- Excellent price-performance ratio for all functional principles



RELIABLY IDENTIFY OBJECTS
IN BATTERY WAREHOUSES
BOS optical sensors

For the formation and aging of battery cells in racks, the presence of pallets must be detected. In addition, the stacker cranes must be correctly positioned before loading and unloading of a cell pallet is initiated. We have a wide range of optical sensors that are ideally suited for use in the intralogistics of cell production.

Features

- Reliable object detection with various ranges, virtually independent of surface, color and material
- Detects objects in front of a very close background, even if they are very dark in front of a bright background
- Almost constant scanning range, even with different degrees of reflectance
- Only one electrical device without reflector or separate receiver
- Available with red light or the laser red light which is optimal for small parts detection



TEMPERATURE FEEDBACK IN BATTERY
WAREHOUSE
BNI IO-Link hubs

When storing and forming battery cells, sensors are needed to provide feedback on temperature and temperature fluctuations. Our analog IO-Link hubs allow you to digitally connect all temperature signals via IO-Link. Thus, we provide you with a complete network topology for digitized forwarding of originally analog signals.

Features

- Easy and cost-saving installation and maintenance
- Detects short circuit and overload or cable break at the port
- Great flexibility due to a wide range of variants



ROBOT POSITIONING IN BATTERY
STORAGE
BML magnetically encoded positioning system

Special expectations are associated with shelf conveyors in cell finishing: optimized goods cycle, higher delivery capability and availability. Robots are therefore used for gripping and positioning battery cells. The magnetically encoded belts of our measuring system are used for precise positioning in highly dynamic applications.

Features

- Contactless and wear-free
- Measuring lengths up to 48 m
- Very accurate thanks to high resolution



Module and pack assembly

TRACEABILITY AND FLEXIBILITY IN ALL STEPS.

 *innovating automation*

After successful completion of the quality inspection, the battery cells are assembled into modules and finally into battery packs. This is done in highly automated production lines. The production of battery modules is divided into four main areas. In the pre-assembly area, the battery cells are tested and prepared for assembly. In the second area, the raw module is assembled from several battery cells. In the third area of the assembly line, the battery modules are electrically connected. In the last part of the assembly line, final testing takes place.

In the assembly lines for battery packs, the modules are assembled into complete battery packs that also contain the battery cell and thermal management system. Depending on the size and cell type, a battery pack can contain thousands of battery cells - and they all have to be connected in series or parallel. Multiple assembly and testing stations are required to ultimately produce a high-quality battery pack for installation in vehicles. Larger OEMs produce the battery packs internally near the vehicle assembly site to improve supply chain efficiency. Depending on the level of automation, battery pack handling can also be done via dedicated carts or AGVs.

With our vision offering, you monitor all steps in the assembly process. Reading codes, for example, ensures that the right cells are assembled. Our IO-Link portfolio enables automated, networked and modular assembly structures. At the same time, our RFID products ensure seamless identification of your modules and packs.

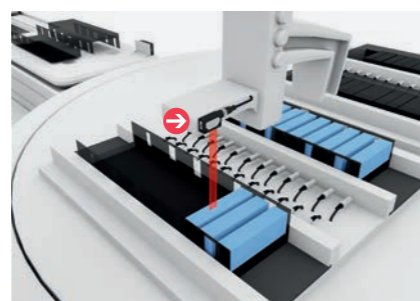


IDENTIFY BATTERY CELLS RELIABLY
BVS IdentSensor

Our new Ident Sensor provides you with optimum support in avoiding quality defects during the processing of battery cells into modules or packs. It reliably detects both barcodes and 2D codes within the production processes, ensuring that the right cells are always used. In addition, the sensor is part of Balluff's Smart Automation and Monitoring System, so that sensor parameters or additional condition monitoring information can be read out at any time via REST API and MQTT.

Features

- Reliable code reading with simple operation
- Uses IO-Link as process and data interface, alternatively TCP or UDP
- Part of SAMS (Smart Automation and Monitoring System)
- Additional IIoT data interfaces: MQTT and REST API
- Additional condition monitoring information for production optimization



DETECT CELL PRESENCE DURING BATTERY INSTALLATION
BOS photoelectric proximity switches

During the robotic assembly of your battery modules, our photoelectric proximity switches reliably detect the presence of individual battery cells – regardless of their surface, color and material. This enables a smooth and automated assembly process of the module or pack in cell-to-pack technology.

Features

- Different ranges
- Detects objects even in front of very close background and independent of surface, color, material
- Almost constant scanning range even with different degrees of remission



POSITIONING BATTERY CELLS IN MODULES AND PACKS
BVS 3D cameras

Robots are used to produce battery modules by placing multiple cells in the correct order, or to place modules in the pack with the required accuracy. Our smart 3D camera forwards processed 3D information such as pick points directly to the robot application.

Features

- Smart 3D camera for robot applications
- Easy operation through user-friendly, web-based user interface
- High flexibility due to optional software modules and GigE Vision interface
- Low system costs due to on-board processing and smart, application-specific software modules



TRANSMITTING ENERGY FLEXIBLY AND WITHOUT WEAR
BIC inductive couplers

On rotary indexing tables, data must be transmitted from rotating to stationary machine parts. Slip rings are usually used for this purpose, but their inevitable wear often leads to failures and expensive downtimes. Inductive couplers from Balluff are the better choice here: They transmit energy and signals for sensors and actuators without contact across an air gap of up to 5 mm – safely, quickly and with optimized performance.

Features

- Easy installation, mounting and replacement thanks to plug-and-play and M12 plug-in connection
- No mechanical wear, completely maintenance-free
- Overheating protection due to internal temperature monitoring
- High protection class (IP67)
- Transmission of high power (up to 120 W)



AUTOMATE GRIPPER CHANGES
BIC inductive couplers

Inductive couplers are the right choice for automating gripper changes in battery assembly because they transmit signals and energy without contact via an air gap. There is no need for mechanical contacting of connectors that are sensitive to contamination, and the robot has a continuous movement radius of 360 degrees.

Features

- Maintenance-free transmission without mechanical wear or cable breakage
- Easy installation due to plug-and-play
- Short set-up times thanks to automated gripper changes
- More function queries, even in previously inaccessible places
- Simple network connection via IO-Link

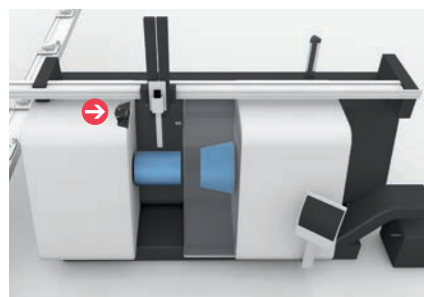


TRANSMITTING ENERGY AND SIGNALS WITHOUT CONTACT
BIC inductive couplers

To increase the number of pieces in module and packing lines, robotics is indispensable for industrial production. Modern robot systems require many sensors – especially for the gripper and the tooling. These sensors must be as small and light as possible to ensure dynamics and minimize energy consumption. Cumbersome wiring of multi-core cables often conflicts with the demand for high efficiency. With inductive couplers from Balluff, you can easily overcome these hurdles and achieve maximum utilization of your production.

Features

- Sending data and current via an air gap
- Risk of cable breakage virtually eliminated
- No need to contact mechanical connectors
- Continuous movement radius of 360°
- Higher uptime of the system due to fast gripper changes

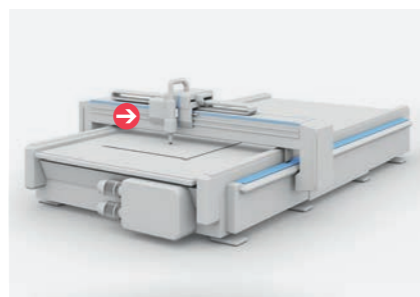


EXACT POSITION AND END POSITION FEEDBACK ON GANTRY LOADER
BML magnetically encoded positioning system

Our absolute magnetically encoded position and angle measuring system is convincing in all applications where highest position and end position accuracy are required. Since it is allowed to leave and return to the detection range of the magnetic tape, it offers a simple and economical solution for demanding applications in automation and machine tool building. The system can also be easily retrofitted.

Features

- Contactless and wear-free
- Measuring lengths up to 48 m, high system accuracy up to $\pm 12 \mu\text{m}$
- Easy installation due to high reading distance up to 1.3 mm
- Status LED and diagnostic functions for safe operation and faster maintenance
- Space-saving, compact form factor for easy integration

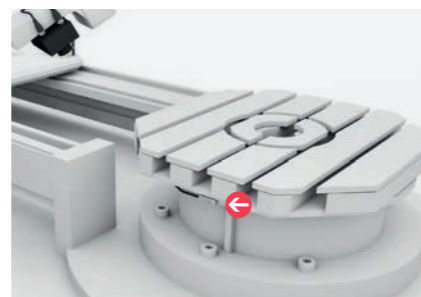


EXACT POSITION FEEDBACK FOR LASER CUTTING/WELDING
BML magnetically encoded positioning system

Our absolute measuring system is convincing in all applications where a high absolute accuracy of positions and end positions is required – e.g. when processing module and package housings as well as bus bars by laser. It was developed for measuring and positioning applications and combines the advantages of a magnetic encoder system with IO-Link, the most innovative interface in the automation world. Position information is conveniently output via the integrated IO-Link interface. An optional analog interface is available for control applications.

Features

- Simple connection via IO-Link
- Up to 8 m position measurement with high accuracy
- Great flexibility due to extensive parameterization functions as well as diagnostic and status information via IO-Link
- Easy installation and safe operation due to high reading distance up to 1.3 mm
- Optional analog measurement output for control applications



PRECISE POSITION FEEDBACK ON ROTARY TABLES
BML magnetically encoded positioning system

Flexible and exact positioning of rotary tables is absolutely essential for battery pick-and-place processes. Our SGA absolute magnetic encoder supports you in this, and is especially convincing in applications where absolute position and end position accuracy are required. Since leaving and returning to the detection range of the magnetic tape is permitted, it offers a simple and economical solution for demanding applications in the field of automation and machine tool building. The system can also be easily retrofitted.

Features

- Contactless and wear free
- Measuring lengths up to 48 m, high system accuracy up to $\pm 12 \mu\text{m}$
- Easy installation due to high reading distance up to 1.3 mm
- Status LED and diagnostic functions for safe operation and faster maintenance
- Space-saving, compact form factor for easy integration



TRANSMITTING SIGNALS WIRELESSLY IN ASSEMBLY
BNI IO-Link wireless and BIC inductive coupler

Thanks to IO-Link Wireless, sensors can now be placed directly on the rotary table. This enables precise position monitoring of modules and packs – wirelessly. The energy for sensors and actuators can be transmitted with our inductive coupler.

Features

- Easy configuration via integrated web server
- Frequency range 2.4...2.483 GHz usable worldwide license-free
- Fast and reliable (latency 5 ms, error rate 10^{-9})
- Easily scalable and expandable by integrating additional devices (up to 120 devices)

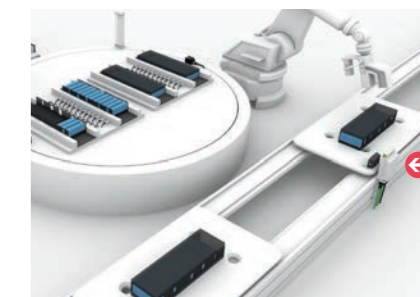


CHECK THE QUALITY OF THE FINISHED BATTERY MODULES
BVS industrial camera

Our industrial camera is ideally suited for quality control of the battery module. With high-resolution images, it facilitates positioning monitoring of the negative and positive terminals during module assembly – and shows you directly whether your module is complete.

Features

- Fast integration thanks to user-friendly software development kit
- Supports a wide range of image processing libraries
- Multiple interfaces: Gigabit Ethernet, USB3, digital inputs/outputs

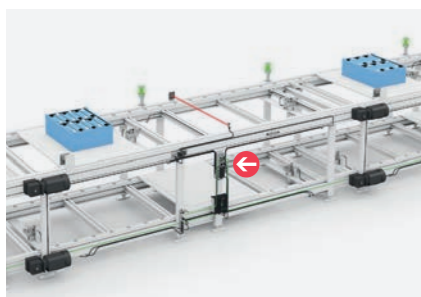


IDENTIFYING AND TRACKING BATTERY MODULES
BIS industrial RFID systems

RFID from Balluff is the first choice for high transparency in battery assembly. Contactless identification makes each individual production step and the materials used in it traceable. RFID data carriers can be read and written to as often as required without visual contact – even if they are dirty. All data is recorded and documented automatically and in real time. This allows you to react flexibly to changes in the process at any time.

Features

- Broad frequency spectrum
- Flexible combination of different systems thanks to frequency-independent evaluation unit
- Simple and fast commissioning
- 4-pole wiring and IO-Link components available



OPTIMIZE CONVEYOR TECHNOLOGY BNI network modules

In order to master the complexity of assembly lines in battery production with confidence, we are increasingly relying on decentralized concepts. For example, up to four drives with 4 A output current can be controlled via our IO-Link network modules, so that both conveyor motors and electric stoppers on your roller conveyors can be operated specifically when required. This allows you to reduce the load on the controller and process information efficiently, increasing productivity and reducing energy consumption.

Features

- Rugged construction
- Fast installation and simple integration
- Separate drive actuation
- Integrated web server for configuring and displaying module information
- Innovative address plug for simple module replacement



TRACEABILITY IN MODULE, PACK AND SYSTEM ASSEMBLY BIS V industrial RFID systems

Traceability is becoming increasingly important for efficient battery production. It creates transparency and is indispensable for the factory of the future with self-controlling processes. Traceability means being able to trace every step of a process chain. You can do this with RFID: The system automatically documents the history of all production parts and all materials and equipment used in the process – including time, location and process. You have real-time access to all information.

Features

- Robust BIS V processor unit: fast data transfer, short cycle times, increased data security
- Different RFID technologies (LF, HF, UHF) can be used simultaneously on a single processor unit
- Four individually configurable ports, operation with up to four read/write heads simultaneously possible
- IO-Link-capable sensors and actuators or sensor hub with up to 16 sensors can be connected to an integrated IO-Link master port



RELIABLY POSITIONING PALLETS AND ADAPTER PLATES BES inductive sensors

Many different inductive sensors are used in the assembly of modules and packs, depending on the application. Our factor 1 inductive sensor family provides a reliable and economical solution for your metal detection applications. They detect any metal – including steel, aluminum or brass – with identical sensing distance, without reduction factor.

Features

- Reduction factor 1
- Insensitive to magnetic fields
- Flexible installation due to rotatable active face
- Clearly visible operation and function display



AUTOMATE QUALITY ASSURANCE BVS industrial camera, BOS light barriers, BNI SmartLight

Industrial image processing is indispensable for modern, flexible manufacturing. It ensures product quality and enables efficient manufacturing processes. This is also the case in module and pack lines, where inline quality control is essential after several assembly processes. Balluff solutions pave the way to high-performance, automated quality assurance. Our growing product portfolio in the field of industrial image processing offers almost unlimited possibilities – from visual quality inspection to identification or positioning tasks.

Features

- Industrial camera: visual quality control of finished parts and their production (size, distance, position, alignment, completeness, correctness)
- Photoelectric sensors: economical alternative to intelligent systems; reliable exclusion of production errors
- IO-Link signal tower SmartLight: visualization of trends and processes via color scale of LED display

Our strengths

PRECISION AND COMMUNICATION

 *innovating automation*

As an automation specialist, we have already launched numerous innovations. Nevertheless, we do not stand still: We want to actively shape the future of digitalization and the Industrial Internet of Things. That's why we deliver precise, intelligent and networked solutions that make you and your production fit for the future. We are the right partner for the automotive industry and for automotive suppliers to sustainably meet the challenges around flexibility, plant availability, quality and data management in the industry.

We offer you various future-proof concepts for your modern battery production: from IO-Link for improved process quality to track and trace with RFID and industrial image processing to data integration and processing with IIoT solutions. In this way, we support you in optimally implementing your individual requirements - both today and in the future.



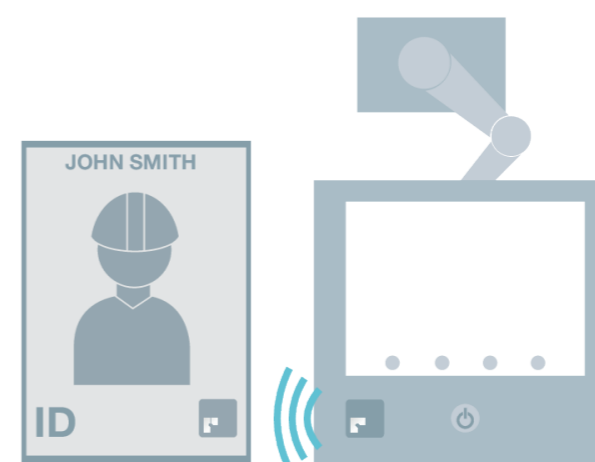
Industrial RFID systems

CONTROL MACHINE ACCESS

With Industrial RFID systems from Balluff, you limit access to machines in a controlled and tamper-proof manner. Differentiation between persons provides restricted access to specific machine information and settings. The views for the user interface can be swapped automatically. Access control allows operator working hours to be viewed and regular maintenance to be tracked.

Features

- Individualized access levels for machine setup or MRO
- RFID key and special locking system for easy integration of secure processes
- Personalized or neutral identification of operators
- Access for temporary remote control
- Easy to install
- Cost-effective
- Visualization of the access level with SmartLight
- Color-coded key fobs for different user roles



Measuring systems

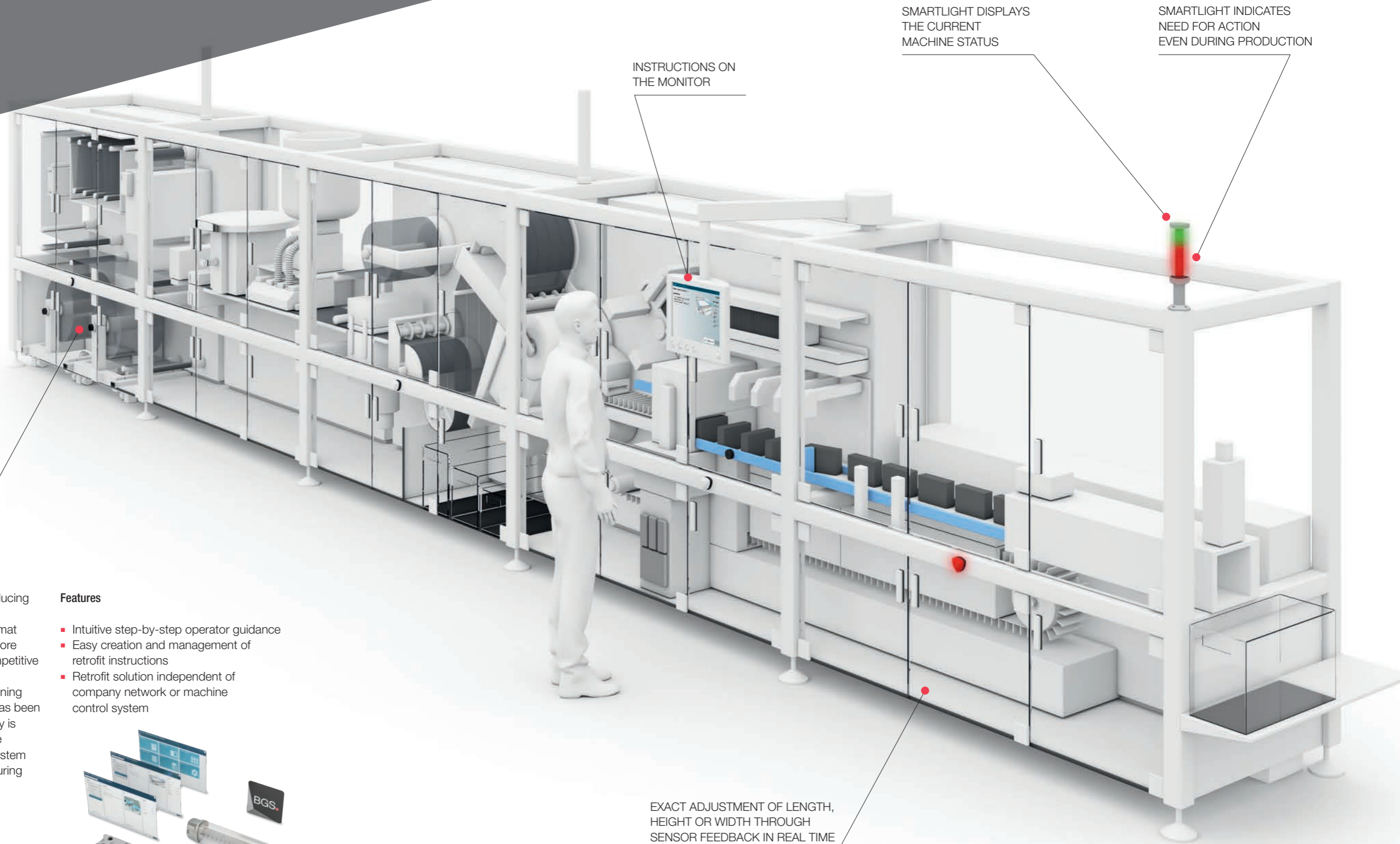
GUIDED FORMAT CHANGE

THE SELECTION OF THE CORRECT REPLACEMENT PART IS CHECKED BEFORE INSTALLATION

Battery cell manufacturers are producing an increasing variety of cell types. Frequent batch and associated format changes are therefore becoming more and more the norm. To remain competitive in today's market, fast and efficient changeovers are essential. Determining whether the changeover process has been carried out completely and correctly is essential. Format, recipe and grade changes can be carried out with system support using various Balluff measuring systems.

Features

- Intuitive step-by-step operator guidance
- Easy creation and management of retrofit instructions
- Retrofit solution independent of company network or machine control system



INSTRUCTIONS ON THE MONITOR

SMARTLIGHT DISPLAYS THE CURRENT MACHINE STATUS

SMARTLIGHT INDICATES NEED FOR ACTION EVEN DURING PRODUCTION

EXACT ADJUSTMENT OF LENGTH, HEIGHT OR WIDTH THROUGH SENSOR FEEDBACK IN REAL TIME

Smart Automation and Monitoring System (SAMS)

MONITOR COMPLETE CELL PRODUCTION



Balluff offers a system for all areas of cell production – from raw material handling and electrode production to cell assembly and final intralogistics. All sensors have embedded “smart features” that provide process and condition data as well as valuable diagnostic data for deeper analysis, sourcing of trends and better planning of product replacement and maintenance. Condition monitoring features include vibration and tilt detection, moisture measurement and temperature monitoring.

Features

- Uniform configuration and diagnostics concept as well as consistent display concept
- Extended IO-Link functionality: Smart features such as internal temperature and humidity monitoring as well as logic modules

Modular control concepts

WHY IO-LINK IS THE FAST LANE



From parallel wiring to fieldbus protocol

Replacing parallel wiring with the fieldbus was a huge step: it successfully eliminated the immense installation effort required using expensive copper cables, and significantly reduced costs. But fieldbus protocols are not without their pitfalls.

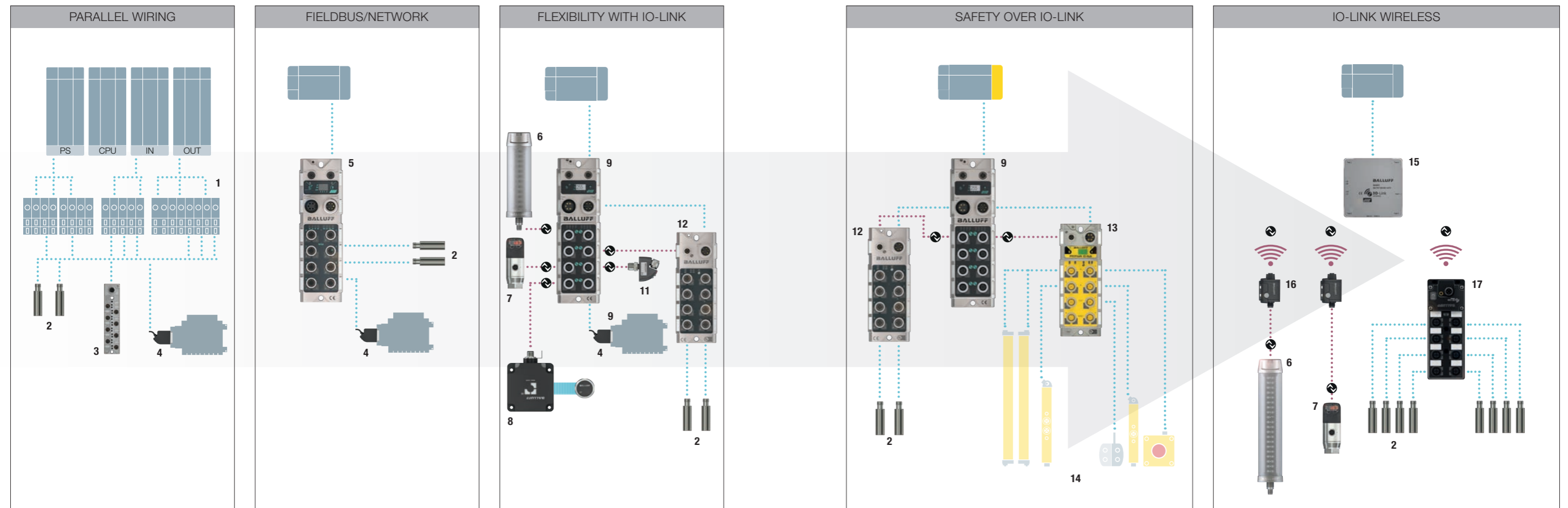
However, IO-Link takes flexibility much further. With Safety over IO-Link, Balluff offers you the first safety solution that can be integrated with IO-Link to combine safety and automation technology in a single system. Safety over IO-Link provides both sensor/actuator details and secure information, so you can benefit from the best of both worlds with our safety concept.

Universal, simple and flexible: IO-Link!

With IO-Link, the weaknesses of the fieldbus protocol are a thing of the past. The unshielded, three or four-conductor standard industrial cables you require are highly flexible and suitable for many bending cycles. They are easy to connect, cost-effective, and connection is standardized with M5, M8 or M12 connectors. You can therefore use IO-Link to access an established standard in order to integrate a wide variety of devices. IO-Link guarantees you extremely flexible control designs. It is because of this versatility, simplicity and high performance that IO-Link is referred to as a universal interface – like USB – for automation systems.

IO-Link: Now also available in wireless

Our wireless system consisting of master, hub and bridge is a new wireless standard that meets the high demands of factory automation. The wireless master does not receive its data via cable as usual, but receives the sensor data via a bridge or a hub by radio. This brings decisive advantages over a wired system, including simpler planning and installation, greater flexibility in design and mobility, and no wear and tear on connectors or cables. And it comes with the proven reliability and performance of wired IO-Link.



- 1 Clamping block
- 2 Sensors
- 3 Junction block
- 4 Valve interface
- 5 Fieldbus module
- 6 IO-Link SmartLight
- 7 IO-Link pressure sensor
- 8 Industrial RFID system
- 9 IO-Link master
- 10 IO-Link analog converter
- 11 IO-Link valve interface
- 12 IO-Link sensor hub
- 13 IO-Link safety hub
- 14 Safety components
- 15 IO-Link Wireless master
- 16 IO-Link Wireless bridge
- 17 IO-Link Wireless hub

Greater efficiency, lower costs

IO-LINK SAVES TIME AND MONEY.



Simple installation

In addition to the IO-Link master, you only need a standard industrial cable in order to install this universally applicable interface. This allows you to rapidly integrate the intelligent communication standard into the world of fieldbus. It makes integrating even complex devices easy. And you will be especially interested to know that digital communication ensures immunity to interference even without expensive shielded cabling. Analog signals are digitized without any conversion losses whatsoever. Where classic data transmission was previously impossible or only possible with difficulty, the IO-Link Wireless standard offers a new, promising solution for the factory of the future.

High machine availability

IO-Link enables fast, fault-free sensor replacement and prompt commissioning. This enables you to significantly reduce downtime, because the parameters of an IO-Link sensor you replace are automatically written from the IO Link master or from the controller to the new sensor. Commissioning, format changes and recipe changes can be performed centrally via the function modules of the control. This saves time and minimizes error potential. Another advantage for you: IO-Link devices cannot be mistakenly swapped, since they can be identified automatically via IO-Link.

Demand-based maintenance

Continuous diagnostic data of the entire process extends your service intervals, because automatic readjustment via IO-Link means you need to maintain equipment and machines much less often. Predictive error detection is now also possible because the complete process parameters are continuously displayed in the control system.

Efficient operation

With IO-Link you can optimally position sensors directly in the machine as the process requires, because accessibility is no longer a factor. Process monitoring, configuration and error analysis of the IO-Link devices now takes place in the controller. This optimizes machine process time considerably. In addition, signal delays and distortions are reliably eliminated because digital data transfer ensures high signal quality.

A broad range of application demands can be easily achieved with IO-Link because you can use both binary and analog standard devices with IO-Link sensors / actuators at the same time.

STANDARD SENSORS/ACTUATORS

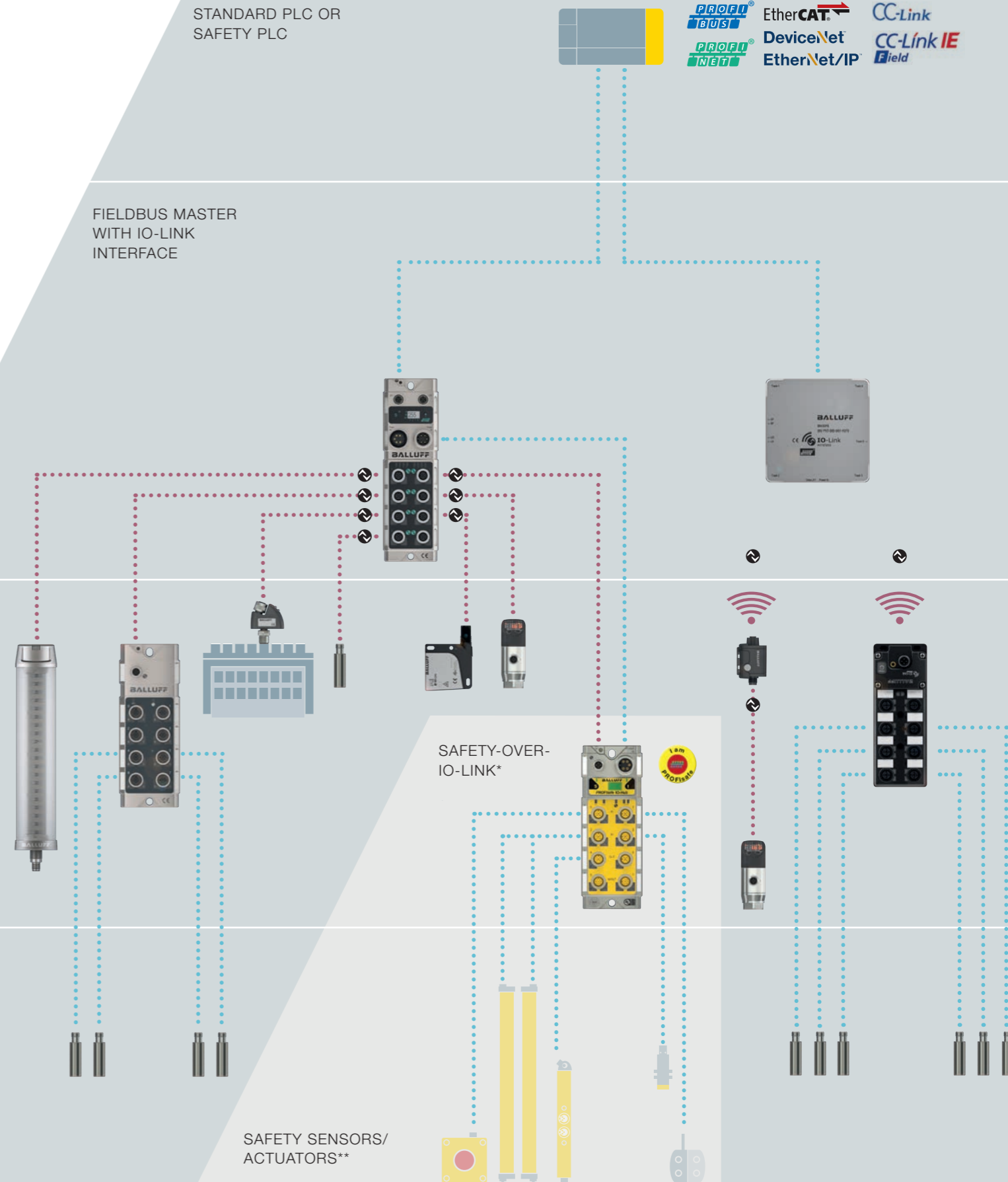
STANDARD PLC OR SAFETY PLC

FIELDBUS MASTER WITH IO-LINK INTERFACE

IO-LINK DEVICES

SAFETY-OVER-IO-LINK*

SAFETY SENSORS/ACTUATORS**



* can only be used with Profinet
 ** not in Balluff delivery program

Balluff Engineering Tool (BET)

SET UP IO-LINK DEVICES EASILY AND ERROR-FREE

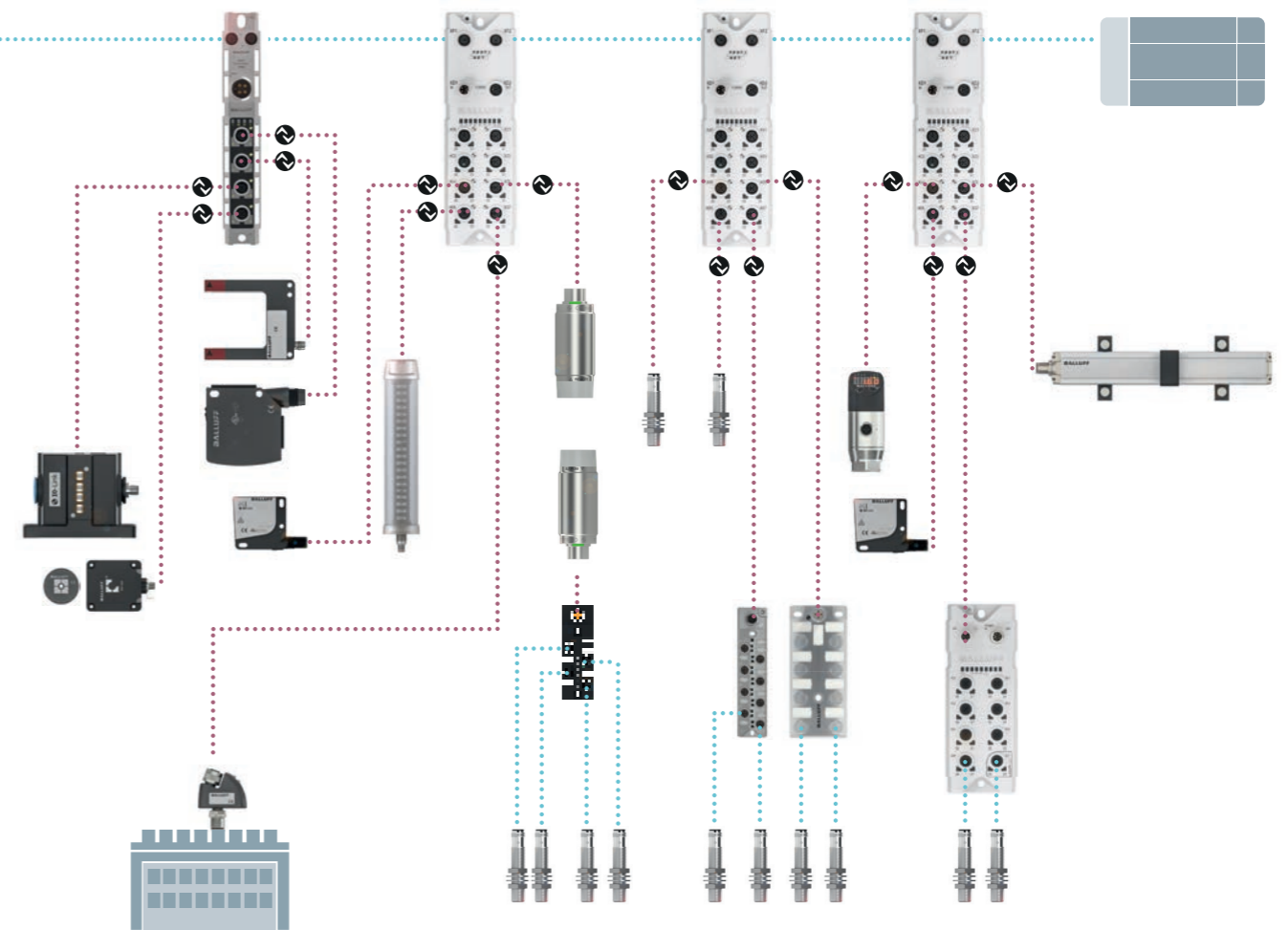


More and more IO-Link devices are being used in industrial automation, all of which need to be parameterized and diagnosed. Our Balluff Engineering Tool software, BET for short, enables manufacturer-neutral commissioning and configuration of IO-Link devices according to the IO-Link standard for sensors and actuators. This allows you to parameterize and commission your IO-Link devices even more easily and efficiently. BET shows you the status of all IO-Link devices in your network topology at a glance. You receive notifications about IO-Link events, can easily document the current state of the topology and test inputs and outputs completely without a PLC. In addition, you can use this software to set up IO-Link devices easily and independently of the manufacturer. You need fewer different software tools and save time and money for updates and staff training.



Features

- Easy setup of IO-Link devices, even without a PLC
- Faster and error-free commissioning, as IO-Link device settings can be saved and reused
- Avoidance of wiring errors and reduction of time-consuming troubleshooting by testing the IO-Link wiring before commissioning
- Overview of entire IO-Link topology and its status
- Only one software package for all IO-Link sensors and actuators, regardless of manufacturer and for all Balluff Profinet and Ethernet/IP IO-Link network modules
- Part of the Balluff Smart Automation and Monitoring System (SAMS) with a large selection of devices and uniform, standardized configuration and diagnostic concept



Track and trace with industrial RFID

PERFECTLY COORDINATED MANUFACTURING AND SELF-CONTROLLING PROCESSES



Automatic identification and tracking

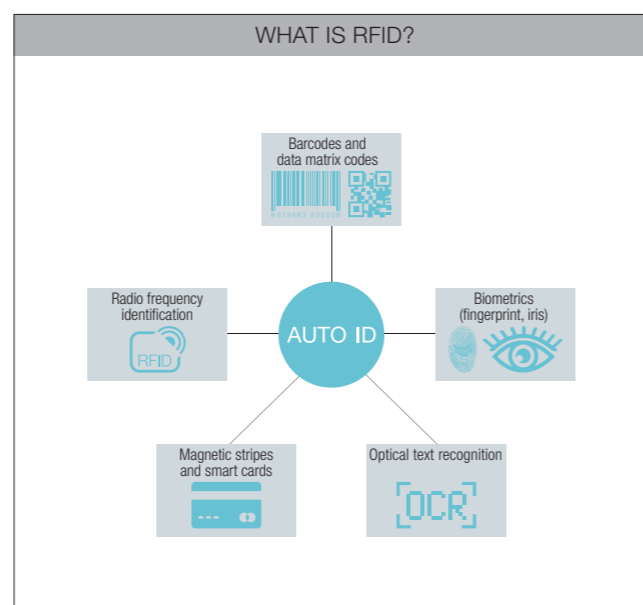
RFID (Radio Frequency Identification) is the communication technology for contactless and automatic identification of objects using electromagnetic induction or radio waves. Our industrial RFID systems offer you the key technology to implement essential requirements of modern manufacturing. Contactless identification makes every production step and every batch traceable, from mixing electrode paste to battery assembly. Thanks to complete transparency, you can react flexibly to changes at any time.

For unique identification and traceability, a data carrier (RFID transponder) is attached to the object to be identified, which acts as a memory. The data is recorded in real time, transmitted between the transponder and the read/write head, and passed on to the control system via the evaluation unit. This ensures high product quality. RFID data carriers can be read and written to as often as required without visual contact, even if they are dirty.

Our building block for the Smart Factory and the IIoT

Industrial identification contributes to the interaction of all systems involved in manufacturing and paves the way for self-controlling processes. This makes the autonomous system an important building block of the smart factory and the Industrial Internet of Things (IIoT).

At Balluff, you get the entire spectrum of RFID technologies with low frequency (LF), high frequency (HF) and ultra high frequency (UHF) for almost unlimited use. This gives you an extraordinary range of components and services in a variety of designs that you can use in a highly variable manner. What's special about this is that our BIS V frequency-independent evaluation unit technology also allows you to flexibly combine all of our RFID systems, sensors, readers and transponders.



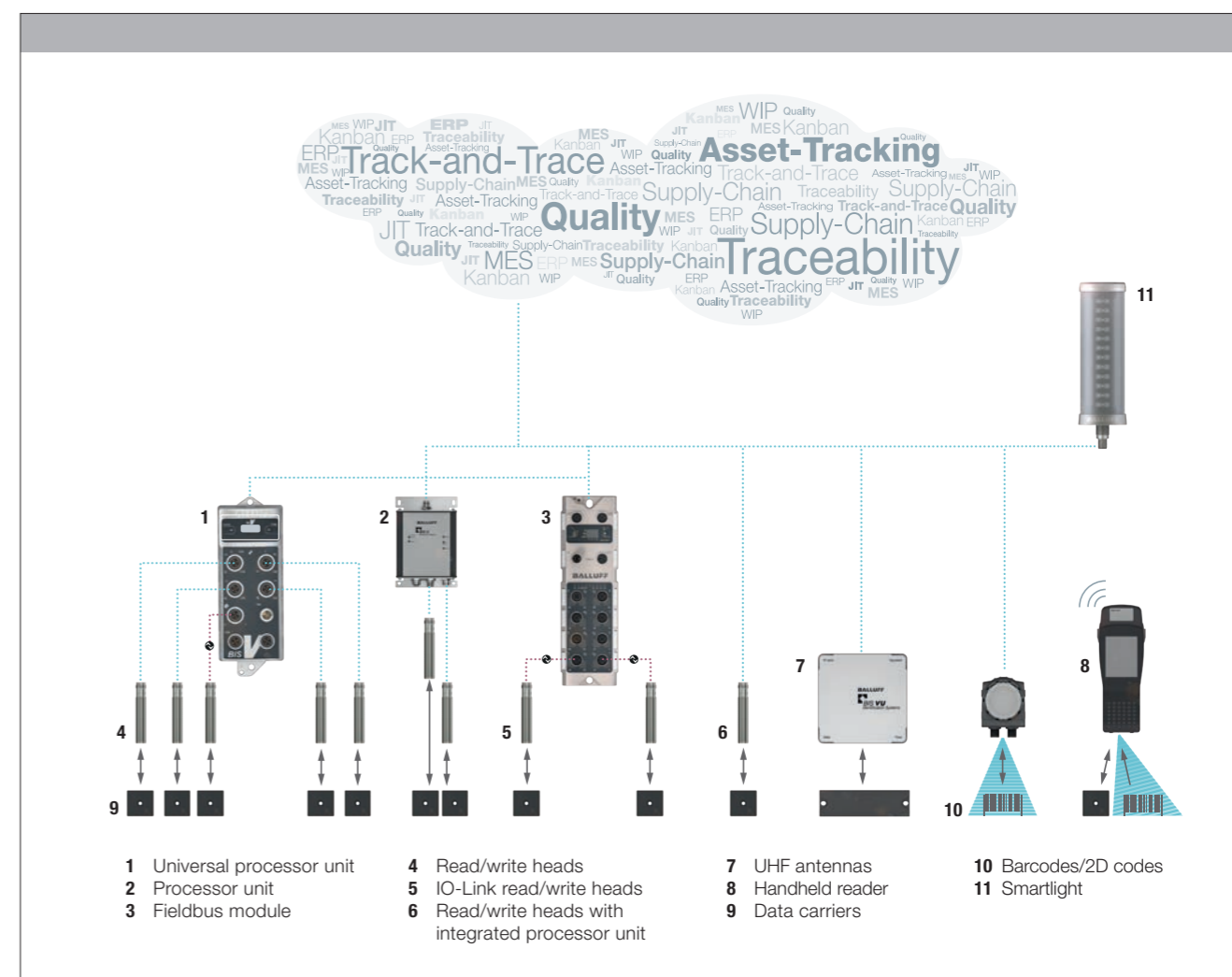
RFID is one of the common auto-ID technologies, along with barcodes, data matrix codes, biometrics (fingerprint), optical text recognition and contact smart cards.

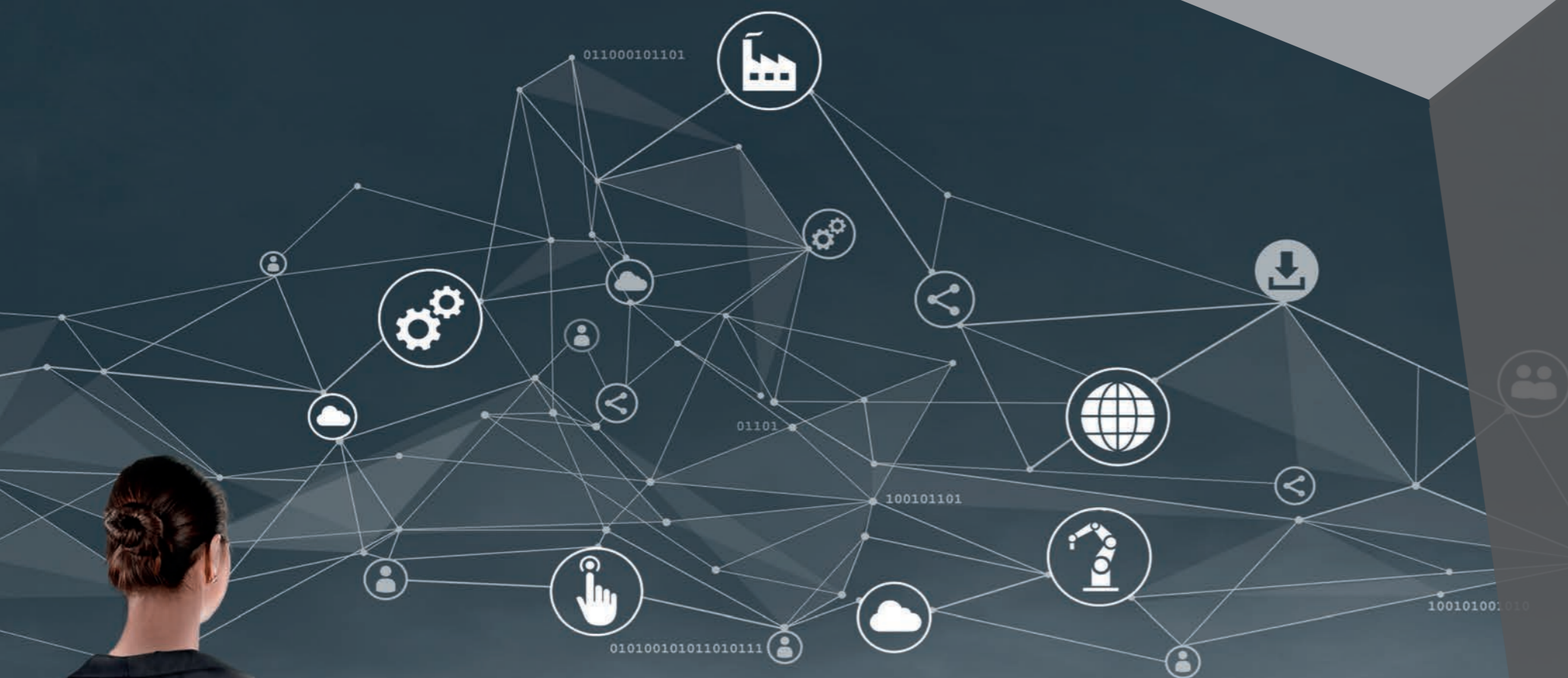
Advantages

- No visual contact between data carrier and reader required
- Long service life of data carriers
- High reliability of the system, even under harsh conditions
- High storage capacity, depending on the data carrier

Usage

- Traceability of different objects
- Management of assets
- Authentication to areas and machines (access control)
- Monitoring of warranty services, spare parts business and maintenance work (plagiarism protection)





#B_IIoT

SEIZE THE OPPORTUNITIES OF THE INDUSTRIAL INTERNET OF THINGS WITH BALLUFF

The future of automation is digital and interlinked. As your automation partner we accompany you step by step on the path to the smart factory. And all the while we keep your competitive ability in view. Build on our expertise and experience – we support you in exploiting the potential of the Industrial Internet of Things (IIoT).

For higher productivity, more efficiency and transparent manufacturing

When it comes to generating and transporting data, we have many years of experience with outstanding success. It is on this basis that Balluff provides you with a constantly growing portfolio of smart devices. Through the use of software, we generate true added value for your production environment. By combining powerful hardware and software, you get intelligent automation solutions – all with the goal of technological advancement.

Utilize the potential of the Industrial Internet of Things – together with Balluff

Our portfolio ranges from the IIoT capable hard- and middleware to software to intelligent system solutions. By using standardized interfaces and protocols we ensure that you can run our solutions in your existing IIoT infrastructure and on common platforms. To this end we of course make use of the communication standard IO-Link. Because IO-Link is ideally suited for the IIoT.

All this makes Balluff an enabler and solution provider for the Industrial Internet of Things.

Questions? Our experts are eager and ready to assist you.

Balluff

YOUR PARTNER FOR SUCCESS IN AUTOMATION



B *innovating automation*

Balluff is a leading supplier of high-quality sensor, identification and image processing solutions including network technology and software for any automation requirement. Family owned for more than 100 years, Balluff currently employs about 3600 people in 37 subsidiaries with sales, production and development facilities around the world to ensure your success. Together with our representatives, we guarantee the highest quality standards in 61 countries so that you always get the best.

We perform top services to increase your competitive ability. We deliver a consistent digital focus, manufacturing expertise, and high personal dedication.

We adhere to our motto "innovating automation" as pacesetters of automation, refiners and new developers, and technological trailblazers. In our strategic incubation programs (SIPs), we develop new future-proof business models according to the lean startup principle. Open exchanges with associations, universities and research institutes also help us in this process. In this way and in close contact with our customers, we create innovative industry solutions for the world of automation. In doing so, we dedicate ourselves not only to the classic automation areas, but also to the development of digitalization and IIoT applications for a digital and networked world.

We always have the future firmly in view in everything we do. We plan with foresight, handle resources carefully and can thus offer you long-term prospects.

You can rely on us, our commitment to you and Balluff quality — all in the spirit of a mutually beneficial partnership.



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