

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

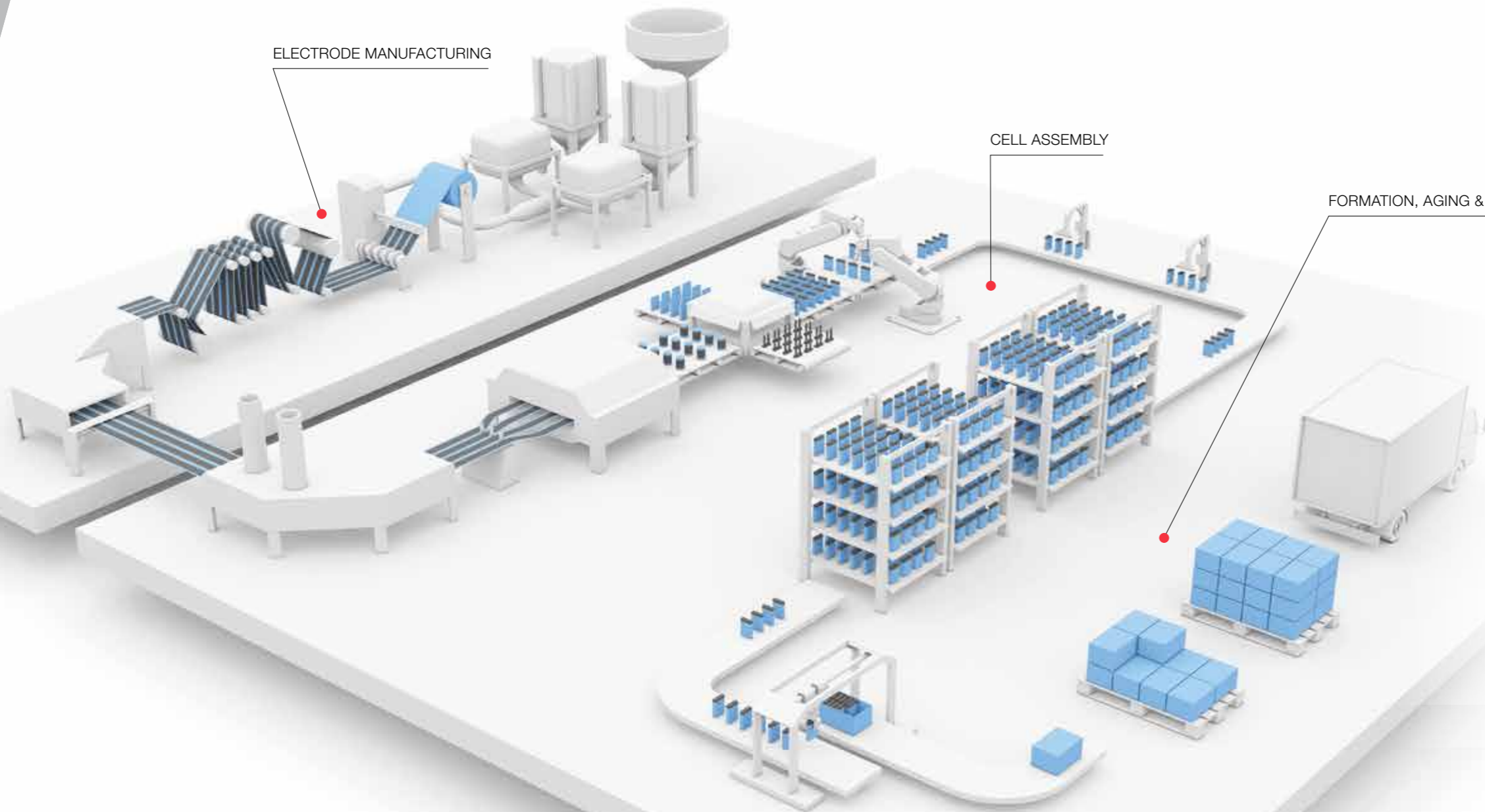
The mobility revolution is in full swing and the battery plays a fundamental role in this transformation, whether for a pure electric, hybrid or fuel cell vehicle. Throughout the production of individual battery cells, modules and packs, machine and plant automation is important for scalable, efficient and reliable manufacturing.

Therefore Balluff supports you in automating your battery production processes from electrode manufacturing to battery pack assembly. We're your single source partner: Our portfolio includes a comprehensive range of future-proof solutions, covering sensors, machine vision, networking and RFID systems

ELECTRODE MANUFACTURING

CELL ASSEMBLY

FORMATION, AGING & TESTING



CONTENT

8
**ELECTRODE PRODUCTION
AND CELL ASSEMBLY**



Quality assurance from the start

16
**MODULE AND
PACK ASSEMBLY**



Traceability and flexibility in all steps

20
**OUR STRENGTHS:
IIoT-LINK AND RFID**



Precision and communication

IIoT 28

ABOUT BALLUFF 30

Electrode production and cell assembly

QUALITY ASSURANCE FROM THE START.

 *innovating automation*

In addition to the mixing of slurry, electrode production and cell assembly also include coating, drying, calendaring, stacking, winding, welding and electrolyte filling. In all such production steps, different parameters and quality characteristics must reliably be maintained. These include, for example, a certain coating thickness, electrode cleanliness and the correct positioning during stacking.

We support you in meeting these high requirements with a broad range of optical sensors in roll-to-roll processes. Furthermore, our positioning systems control the movements of your calender rolls for optimum pressure and traceability solutions enable the identification of the electrode coils.

Solutions for electrode production and cell assembly



IDENTIFY RAW MATERIALS FOR SLURRY PRODUCTION BVS handheld code reader and BIS industrial RFID systems

To produce the electrode paste for the anode and cathode at the start of battery cell production, the raw materials must first be clearly identified. The required active materials, conductive carbon blacks, solvents or binders, and additives are often marked with barcodes. At Balluff, you can find various products for reading these codes, as well as alternative identification solutions. These include handheld readers and RFID systems that identify the relevant raw materials without contact. This lets you ensure the pastes (slurry) are produced according to the recipe and that no quality defects occur.

Features

- IP65 rating
- Withstands falls onto concrete from up to 2 m
- Wired or wireless variant for maximum freedom of movement



CONTROL TUBE STATION QUICKLY AND RELIABLY BIS industrial RFID systems

If you use hoses to fill your mixer, we offer you the optimal solution for a safe process. Self-sufficient RFID systems from Balluff reliably identify each coupling of your hose station and only release it when it is connected to the designated point. This way, you can be sure that the right raw materials enter your mixer and that the electrode paste is produced as desired.

Features

- Robust, since contactless
- Powerful and fast

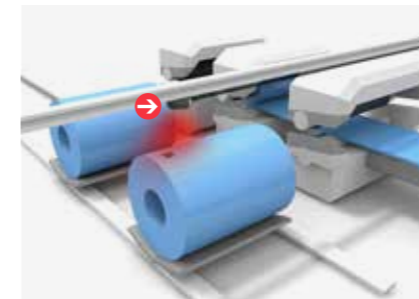


MONITOR MIXER STATUS BCM Condition Monitoring sensors

For trouble-free processes, you can obtain condition monitoring sensors from us. These provide you with condition data for your mixer machine or any other battery production plant, so that you are informed of potential problems at an early stage. Physical variables 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 in advance, an alarm is triggered. The sensors also monitor their own status. All this helps you to avoid unplanned, cost-intensive downtimes and manual inspections.

Features

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



IDENTIFY ELECTRODE COIL BVS handheld code reader and vision sensor

Before the cathode and aluminum foils are coated, they or the coil are identified and recorded in order to keep the use of materials 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 identify your foils. Our portfolio for automatic code capture ranges from manual handheld scanners to vision sensors.

Features

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

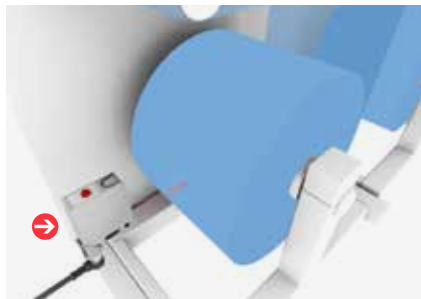


TRACK AND TRACE ELECTRODE COIL BIS industrial RFID systems

Our wide range of solutions in the field of RFID also helps you to avoid the use of incorrect 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 detection without manual scanning processes
- Complete transparency of material usage

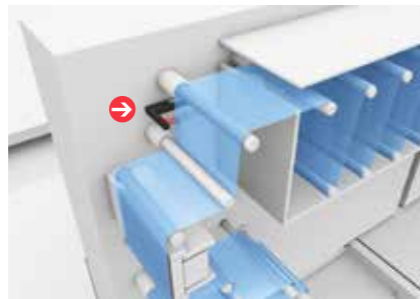


MONITOR MATERIAL AVAILABILITY
BOD optoelectronic distance sensors

To ensure that there is always enough material available for the coating process, our optical distance sensors 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 are also very easy to commission and can be flexibly adapted for your application.

Features

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



FOIL WEB EDGE DETECTION
BGL fork sensors

If aluminum and copper foils for different process steps are fed through your lines by means of rolls, it should be ensured that the material runs in a straight line. This prevents unwanted interruptions, e.g. during drying or calendaring. Our forked light barriers 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)



CONTINUOUSLY TRACK ROLLS
BSI inclination sensors

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

Features

- Contactless and absolute
- Measuring range up to 360 degrees
- Direct inclination measurement without complex special construction

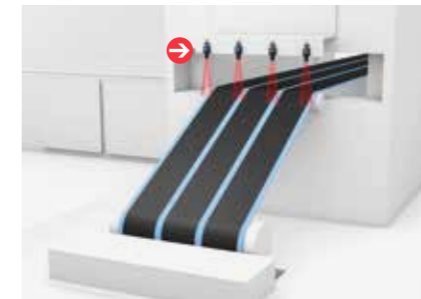


DETECT SPLICE TAPE DURING ROLL CHANGE
BFS color sensors

To ensure a smooth roll change in the material feed, the splices between two rolls must first be reliably detected so that they can be removed in the next step. Our color sensors are ideally suited for this purpose: They reliably detect the splice tapes even over long ranges.

Features

- Very high color resolution
- Robust and suitable for industrial use
- Application-specific parameterization
- Optionally available with IO-Link interface
- Available with and without display



MONITOR COATING PROCESS
BVS industrial cameras

Image processing systems are usually used to automatically check the coating process or its accuracy. Our industrial cameras with integrated block scan mode are the right choice here: They quickly generate perfect images that can then be further processed. With state-of-the-art sensor chip technology, they support optimum inline quality control.

Features

- Easy setup and intuitive usability
- Standardized interfaces
- Robust and suitable for industrial use
- Sharp images, fast data processing

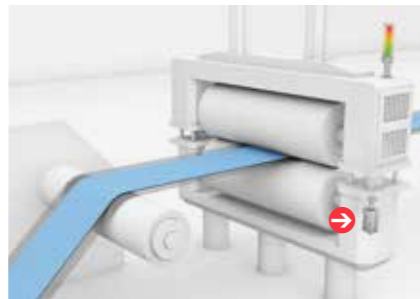


ENSURE PROCESS RELIABILITY
BLA light bands

When conveying coated carrier films, it is important to maintain an optimum 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 to prevent this. Its IO-Link interface also enables central data storage and simple configuration – even in the event of format changes.

Features

- Simple parameterization via IO-Link
- Precise position detection
- Easy size differentiation of diameters
- Quality inspection of gap dimensions
- Precise edge detection



CONTROL CALENDER ROLLS
BTL position measuring systems

To compact the copper or aluminum foils coated on both sides, the movements of the calender rollers must be executed precisely. Balluff position measuring systems control these movements of your calender to ensure 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
- Simple installation
- Insensitive to shock, vibration and dirt
- Multiple interfaces available



VISUALIZE PROCESSES
OF THE CALENDER
BNI SmartLight

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

Features

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

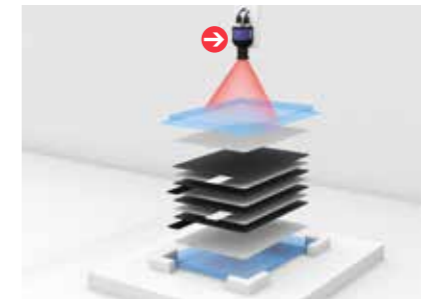


PUNCH TOOL IDENTIFICATION
BIS UHF RFID system

During the anode and cathode notching process, the punch molds need to be reliably identified before loading them into the machine. This ensures the correct tooling is in place for the product variant being manufactured. With the BIS V RFID system from Balluff, operating at UHF, you can automatically validate and monitor your molds dies at ranges beyond 1m. 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



PRECISELY POSITION ELECTRODES
DURING STACKING
BVS industrial camera

During the stacking process for manufacturing the battery 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 central quality criterion. With the Industrial camera from Balluff, you can monitor the stacking process automatically and avoid quality defects as a result of incorrect positioning. In addition, the increased degree of automation keeps your cycle times low.

Features

- User-friendly interface
- Robust housing
- Standardized data interfaces
- Excellent image quality: best inspection results

Module and pack assembly

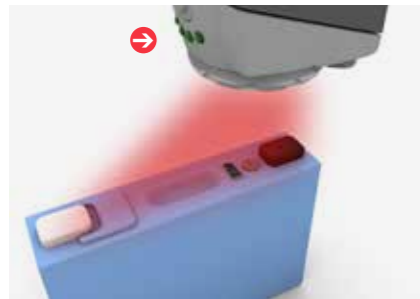
TRACEABILITY AND FLEXIBILITY IN ALL STEPS.

B *innovating automation*

After the final process steps of cell production have been completed, the battery cells are assembled into modules and finally battery packs. This is done in highly automated production lines.

With our vision offer you monitor all steps in the assembly process. Code reading, for example, ensures that the right cells are assembled. Our IO-Link portfolio enables automated, connected and modular assembly architectures. At the same time, our RFID products provide seamless identification of your modules and packs.

Solutions for battery assembly



RELIABLY IDENTIFY BATTERY CELLS
BVS vision sensor ident

Our Vision sensor ident also helps you to avoid quality defects during the further processing of battery cells into modules or packs. It reliably detects bar codes, data matrix codes and even QR codes, thus ensuring that the correct cells are always used. In addition, you can use the camera to visually inspect the weld seam on the battery housing – another important quality assurance step.

Features

- Automated identification of 1D, 2D, stacked or directly marked codes as well as OCR plain text
- Different optics and lightning variants to available



DETECT CELL PRESENCE DURING BATTERY ASSEMBLY
BOS diffuse sensor

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

Features

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

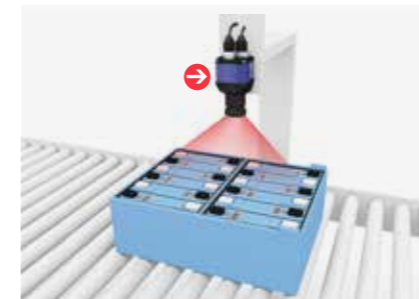


FLEXIBLE AND WEAR-FREE ENERGY TRANSMISSION
BIC inductive couplers

Data must be transferred from rotating to stationary machine parts on rotary indexing tables. 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)



CHECK THE QUALITY OF THE FINISHED BATTERY MODULE
BVS industrial camera

Our Industrial camera is ideally suited for quality control of the battery module. With high-resolution images, the camera facilitates position monitoring of negative and positive poles during module assembly and shows you directly whether your module is complete. Thanks to the reliable identification of codes, you can also easily ensure that the correct battery cells have been installed.

Features

- Fast integration of the cameras into your image processing solution thanks to user-friendly Software Development Kit.
- The software supports a wide range of image processing libraries
- Multiple interfaces: Gigabit Ethernet, USB3, digital inputs/outputs



IDENTIFY AND TRACK BATTERY MODULES
BIS industrial RFID Systems

RFID from Balluff is the first choice for high transparency in battery assembly: The contactless identification makes each individual production step and the materials used in the process 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

- Wide 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

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 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.



Modular control concepts

WHY IO-LINK ON THE FAST LANE IS.



From parallel wiring to fieldbus protocol

Replacing parallel wiring with fieldbus use was a huge step. Because the fieldbus protocol successfully overcame the immense installation effort with expensive copper cables. And significantly reduced costs. But fieldbus protocols are not without their pitfalls.

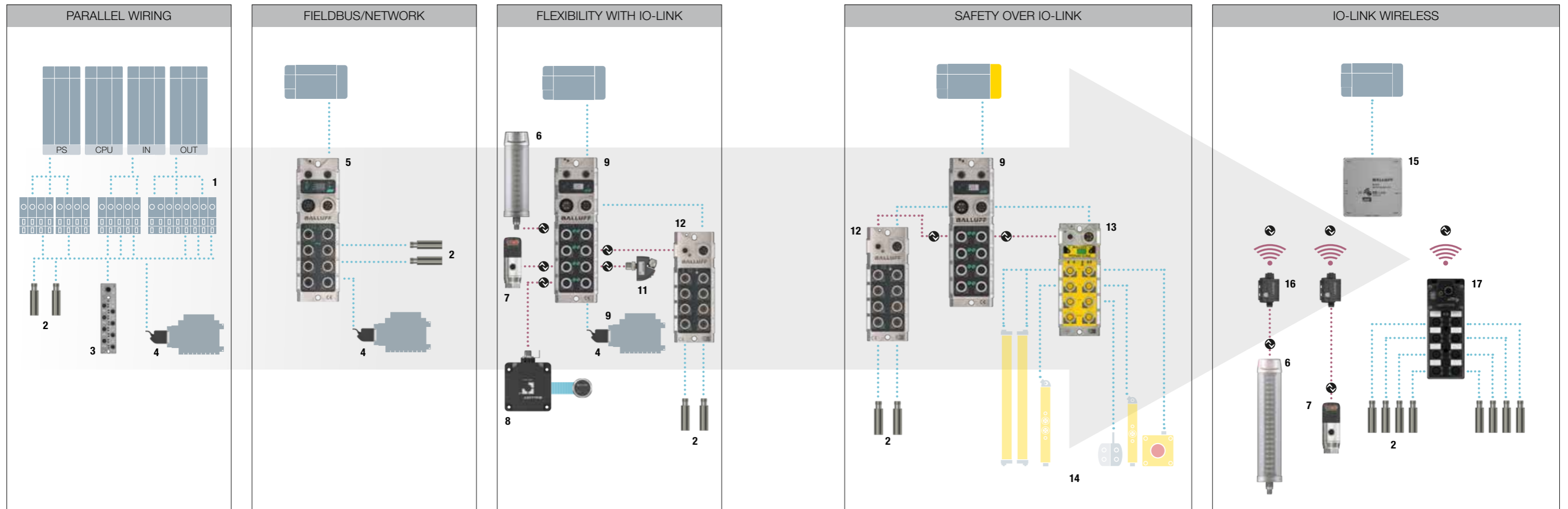
Universal, simple and flexible: IO-Link!

The weak points of the fieldbus protocol are a thing of the past with IO-Link. This is because the unshielded, three- or four-core standard industrial cables are highly flexible and suitable for many bending cycles. They are easy to connect, extremely cost-effective and their connection is standardized with M5, M8 or M12 connectors. Therefore, with IO-Link, you can rely on a widely established standard to integrate a wide variety of devices. IO-Link thus guarantees you extremely flexible control concepts. Due to this versatility, simplicity and performance, IO-Link can be described as the universal interface - the USB - of automation.

With IO-Link, however, flexibility goes much further. Because with Safety over IO-Link, Balluff offers you the first safety solution that can be integrated with IO-Link, which combines safety and automation technology in one system. Safety over IO-Link provides both sensor/actuator details and information, so that you can use the best of both worlds with our safety concept. the best of both worlds.

IO-Link: Now also wireless

Our wireless system consisting of master, hub and bridge is a new radio standard that meets the high demands of factory automation. The wireless master does not receive its data by cable, as is usually the case, but receives the sensor data via a bridge or 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 that with the proven reliability and performance of wired IO-Link



- | | | |
|----------------------------|-------------------------------------|----------------------------|
| 1 Terminal strip | 7 IO-Link pressure sensor | 13 IO-Link safety hubs |
| 2 Sensors | 8 Industrial RFID system | 14 Safety components |
| 3 Passive distributor | 9 IO-Link master | 15 IO-Link Wireless Master |
| 4 Valve terminal connector | 10 IO-Link analog converter | 16 IO-Link Wireless Bridge |
| 5 Fieldbus module | 11 IO-Link valve terminal connector | 17 IO-Link Wireless Hub |
| 6 IO-Link SmartLight | 12 IO-Link sensor hubs | |

More efficiency, less costs

IO-LINK SAVES TIME AND MONEY.



Easy installation

In addition to the IO-Link master, all you need to install the universal interface is an industry-standard three- or four-conductor core cable. You can quickly integrate the intelligent communication standard into the fieldbus world and easily integrate even complex devices. A particularly interesting feature is that digital communication guarantees interference immunity even without expensive shielded cabling. Analog signals are digitized without conversion losses.

Highest machine availability

IO-Link enables you to quickly replace sensors without errors and to commission them promptly. You can significantly reduce downtime because the parameters of a replaced IO-Link sensor are automatically written to the new sensor by the IO-Link master or the controller. Commissioning, format changes, or recipe changes can be carried out centrally via the function blocks of the controller. This saves you time and reduces the potential for errors to a minimum. Another advantage for you: IO-Link devices cannot be interchanged, as they can be automatically identified via IO-Link.

Demand oriented maintenance

Continuous diagnostic data of the entire process extends your maintenance intervals, since you have to maintain systems and machines significantly less frequently thanks to automatic readjustment via IO-Link. Predictive error detection is now also possible. This is because the complete process parameters are displayed continuously in the control system.

More efficient operation

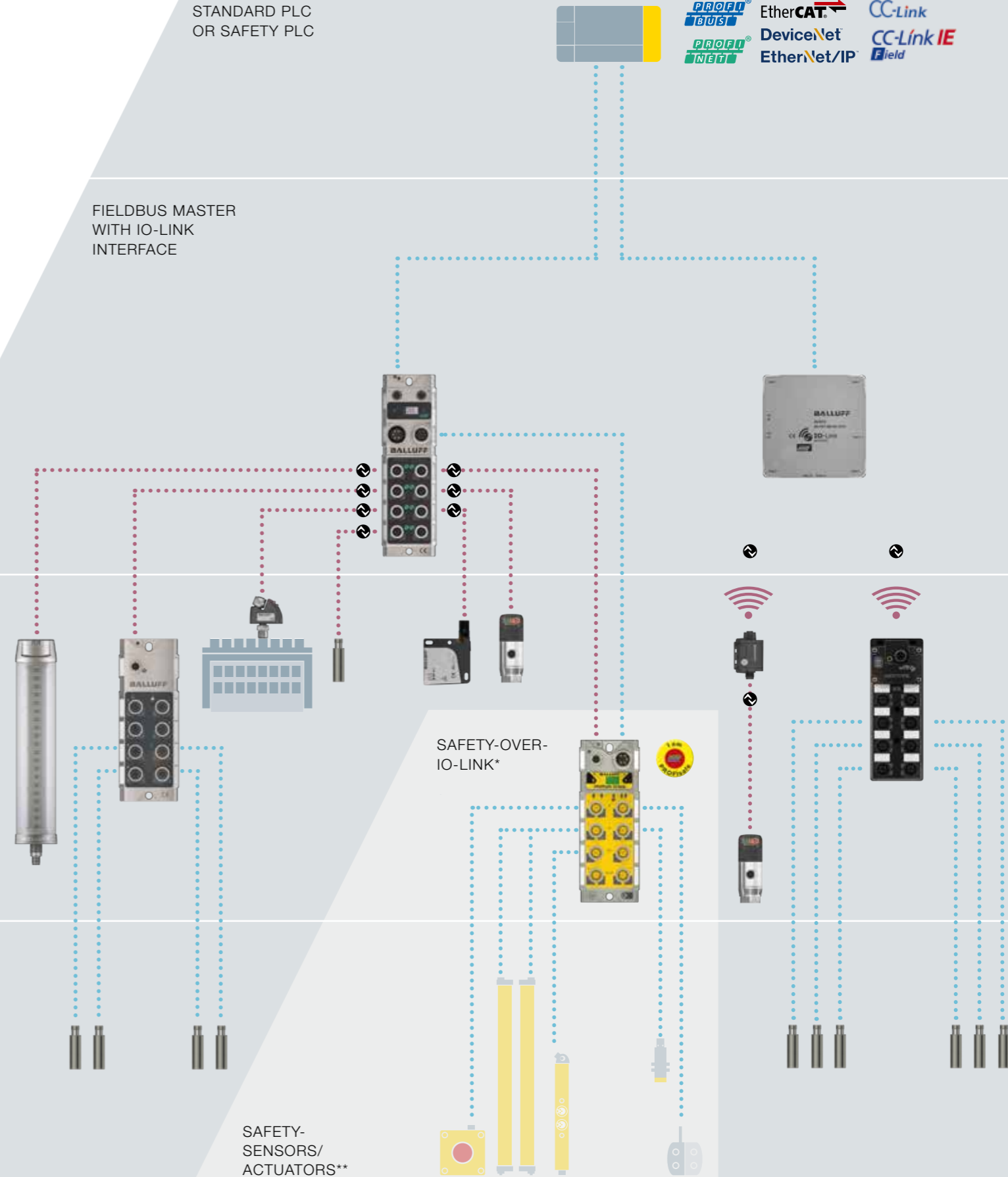
Thanks to IO-Link, you can position sensors in the machine directly at the point of action in an optimal way in terms of process technology, because the accessibility of the sensors no longer plays a role. Process monitoring, parameterization, and error analysis of the IO-Link devices now takes place in the controller. Machine processes are thus optimized in terms of time. In addition, signal delays and distortions are reliably eliminated. This is because digital data transmission ensures high signal quality. Extensive application requirements can be easily implemented with IO-Link. Both binary and analog standard devices can be used simultaneously with IO-Link sensors/actuators.

STANDARD-SENSORS/
ACTUATORS

IO-LINK
DEVICES

FIELDBUS MASTER
WITH IO-LINK
INTERFACE

STANDARD PLC
OR SAFETY PLC



* only usable with Profinet
** not in Balluff delivery program

Track & Trace with Industrial RFID

PERFECTLY COORDINATED MANUFACTURING AND SELF-CONTROLLING PROCESSES



Automatic identification and tracking

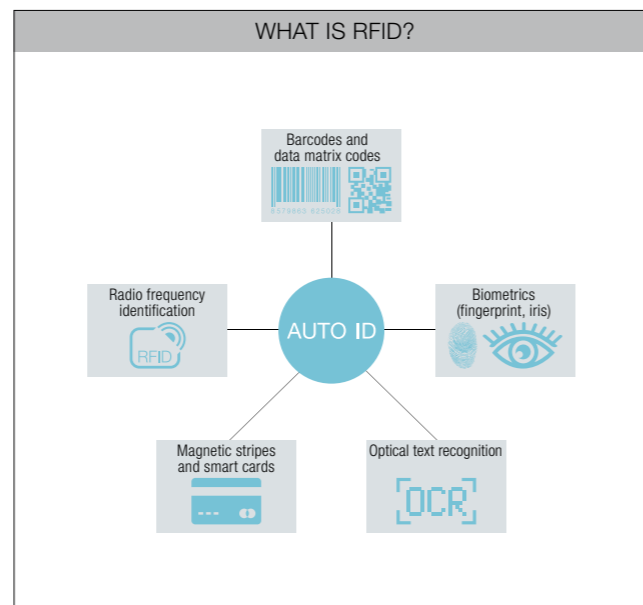
RFID (Radio Frequency Identification) is the communication technology for contactless and automatic identification of objects using electromagnetic induction or radio waves. Our industrial RFID systems offer you the key technology to implement essential requirements of modern manufacturing. Contactless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



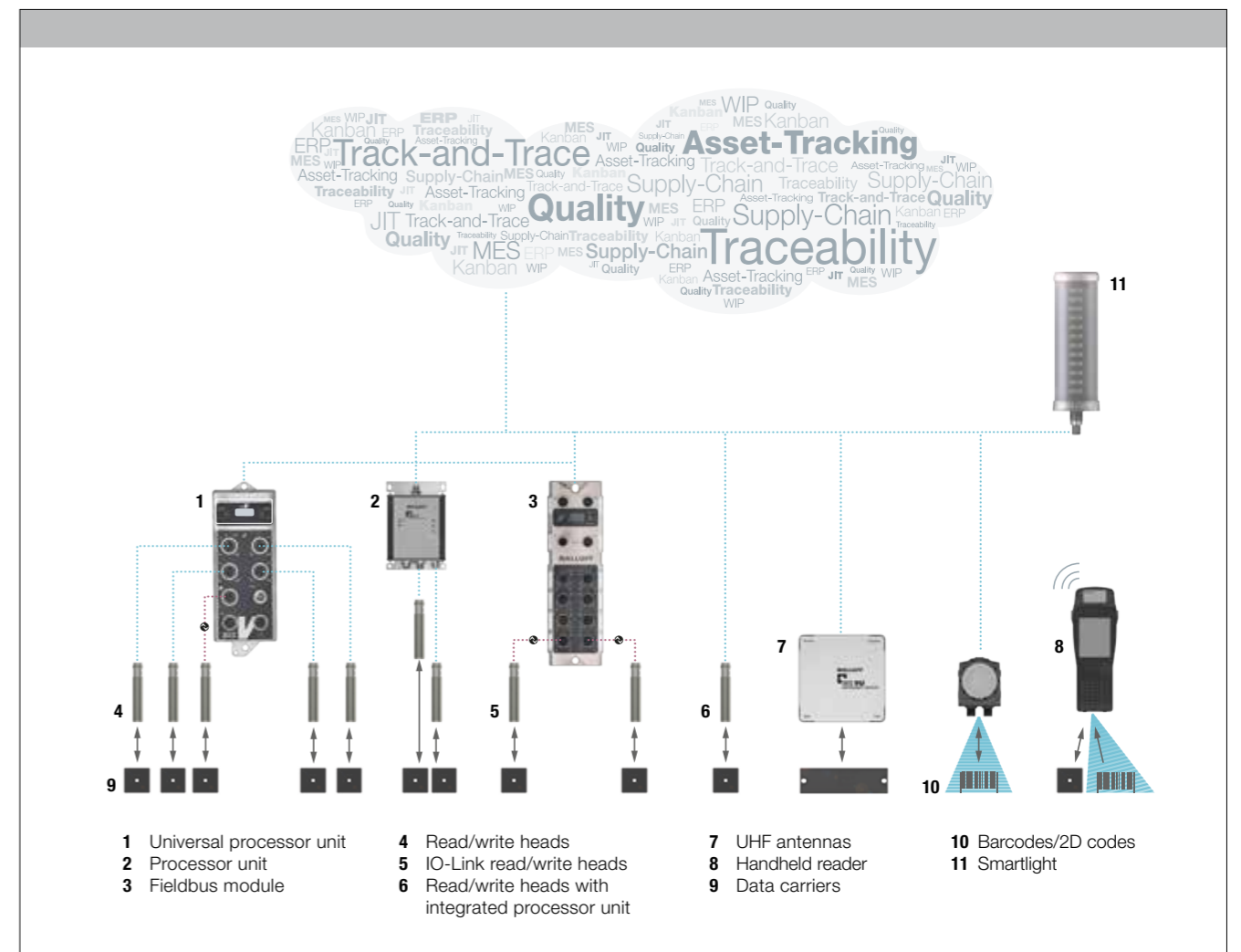
RFID is one of the common auto-ID technologies, along with barcodes, data matrix codes, biometrics (fingerprint), optical text recognition and contact smart cards.

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_IloT

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.

A man in a white shirt is looking out a window at an industrial facility at dusk. The scene is reflected in the water. A digital overlay of a factory building is visible in his hand, with red dots and lines indicating a digital interface.

Balluff

OPENING UP NEW PERSPECTIVES


Balluff is a leading provider of high-value sensor, identification and image processing solutions including networking technology and software for any automation requirement. Family owned for more than 100 years, Balluff currently employs around 3600 persons 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 for innovative solutions that 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 open exchange with associations, universities and research institutes, as well as in close contact with our customers, we create new industrial sector solutions for automation. As a future-looking company we keep our eye not only on the traditional areas of automation, but also devote ourselves to the development of holistic applications for an increasingly digital and networked world.

We have the future firmly in view in everything we do. With a sophisticated environmental management system, we protect the environment and handle our resources with care. This also creates for you the best prerequisites for sustained action.

You can always rely on us, our products and our adherence to delivery dates and schedule – all in the name of mutually beneficial partnership.

 *innovating automation*

CONTACT
OUR
WORLDWIDE
SUBSIDIARIES

Headquarters
Balluff GmbH
Schurwaldstrasse 9
73765 Neuhausen a. d. F.
Germany
Phone +49 7158 173-0
Fax +49 7158 5010
balluff@balluff.de

