BALLUFF

In every field

WE SPEAK IO-LINK. ON A GLOBAL SCALE

CONTENTS

For fast, flexible and efficient production

IO-LINK – THE IDEAL SOLUTION.

innovating automation

Just one interface for improved process quality

Intelligent combining of industrial network with the IO-Link communication standard is the ideal solution for ever faster, more flexible, more efficient and more adaptable production. This provides you with a powerful infrastructure for reliably managing the growing volume of data. It transports your data through the entire manufacturing process and enables seamless communication from the sensor into the Internet, making IO-Link the ideal enabler for Industry 4.0.

Why IO-Link increases the performance of your network

IO-Link is the first globally standardized IO technology (IEC 61131-9) that communicates from the controller down to the lowest automation level. This universally applicable interface is a fieldbus-neutral point-to-point connection which uses standard unshielded cables. IO-Link sends all the sensor and actuator signals to the controller and in turn carries controller data to the sensor/actuator level with revolutionary consequences.

This open standard opens all sensors to the fieldbus level and even transports analog signals noise-free by digitizing them. IO-Link enables fully continuous diagnostics as well as automated configuration of the IO-Link devices via the controller. This means IO-Link is simple to install. In addition to the IO-Link master, all you need is a standard unshielded 3- or 4-conductor cable to connect sensors and actuators.

Modular Control Concepts

WHY IO-LINK IS IN THE PASSING LANE.

innovating automation

From parallel wiring to the fieldbus protocol

Replacing parallel wiring with the use of fieldbuses was an enormous step because fieldbus protocol has successfully eliminated the immense installation effort associated with copper cables and substantially reduced the costs. It is not just that the fieldbus reduces the working time because a bus cable replaces numerous parallel strands of wire. Since fewer strands are needed, also material and space are conserved. Simultaneously, the bus cable connects the components of different levels. Now a system without a control cabinet is possible.

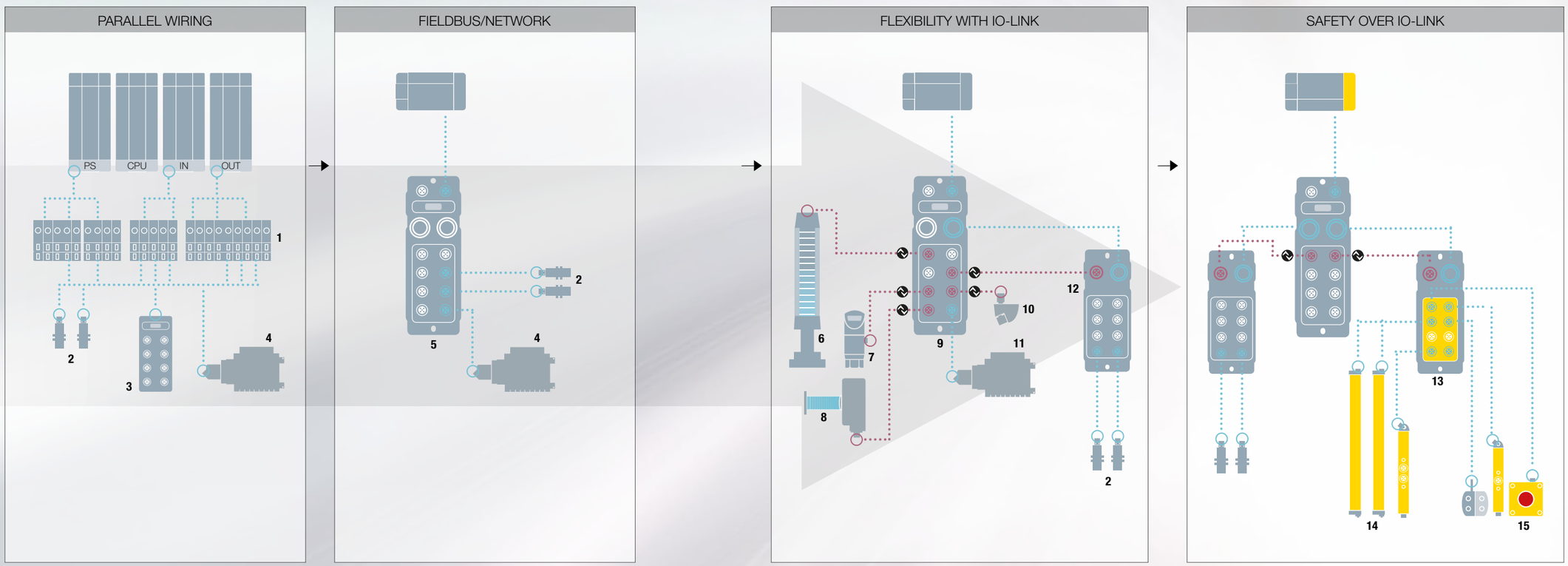
Pitfalls of the fieldbus protocol

But even fieldbus cables are not without problems, even if their protocol is no longer electrical and the cabling effort goes down by orders of magnitude. Fieldbus cables have a low signal level, are noise-susceptible, don't like to be bent and because of the shield are expensive.

Universal, simple and flexible: IO-Link!

The weaknesses of the fieldbus protocol are now a thing of the past thanks to IO-Link because the unshielded, 3- or 4-conductor standard industrial cables are highly flexible and suitable for many bending cycles. They are easy to connect, highly economical, and can use M5, M8 or M12 connectors. Therefore, with IO-Link you can rely on an established standard for connecting the widest possible variety of devices. IO-Link ensures extremely flexible control concepts. This versatility, simplicity and performance capability mean IO-Link can be considered a universal interface – like USB – in automation.

But with IO-Link the flexibility is even much greater because with Safety over IO-Link Balluff offers the first safety solution to be integrated with IO-Link for combining safety and automation technology in one system. Safety over IO-Link provides both sensor/actuator details as well as safety information, so that you can benefit from the best of both worlds with our safety concept.



1 Terminal block
2 Sensors
3 Junction blocks
4 Valve interfaces
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 interfaces
12 IO-Link sensor hubs
13 IO-Link safety hubs
14 Opto-electronic protective devices
15 Emergency stop device

More Efficiency, Lower Costs

IO-LINK SAVES TIME AND MONEY.

innovating automation

Easy installation

For IO-Link all you need is an industry-standard 3- or 4-conductor cable. The uniform standard interface can be quickly and easily integrated into the fieldbus world to simply link even complex devices. One special feature: the digital communication ensures noise immunity even without the use of expensive shielded cabling. Analog signals are digitized with no conversion losses.

Highest machine availability

IO-Link enables quick, error-free sensor replacement and prompt commissioning. You can significantly reduce downtimes since the parameters of a replaced IO-Link sensor are automatically written from the IO-Link master to the new sensor. Commissioning processes, format changes or recipe changes are handled centrally via the controller's function modules. This saves time and reduces the potential for mistakes to a minimum. Another advantage to you: IO-Link devices cannot be mixed up, since they are automatically identifiable via IO-Link.

Requirements-based maintenance

Continuous diagnostic data for the entire process extends your service intervals, since automatic readjustment via IO-Link means you need to maintain equipment and machines much less often. And now predictive error detection is even possible because the complete process parameters are consistently displayed in the controller.

More efficient operation

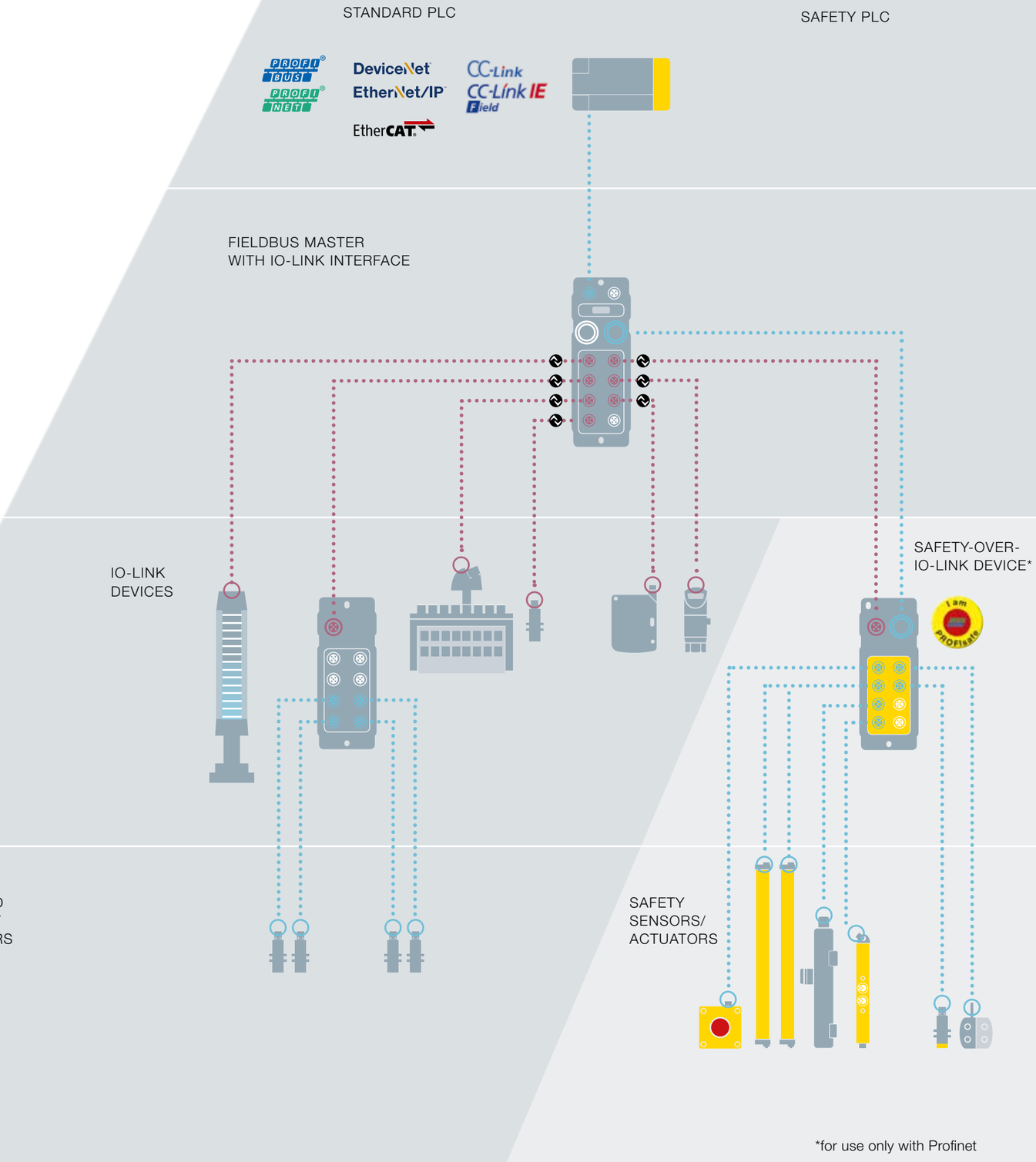
With IO-Link you can position sensors in the machine just as the process requires, since accessibility of the sensors is no longer a factor. Process monitoring, configuration and error analysis of the IO-Link devices now takes place in the controller. Machine sequences are now time-optimized. Signal delays and distortions are reliably eliminated because digital transmission of data also ensures high signal quality.

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

High-performance, consistent network

Controller concepts using IO-Link provide you with simple and universal solutions for a high-performance, consistent network, so that with this universal interface you profit from lower costs and are more flexible than ever.

Use the typical applications presented on the next pages to learn about the possibilities IO-Link opens up for you.



*for use only with Profinet

IO-Link provides a high standardization factor

Migrate Fieldbuses

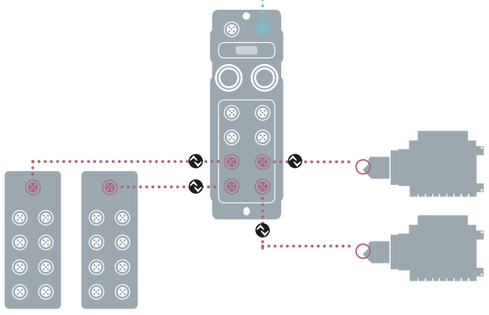
Plug-and-Play in all networks

As a systems and machine builder you market and sell your products around the globe. This means your products have to adapt to the conditions of very different countries. And are tuned to very different networks.

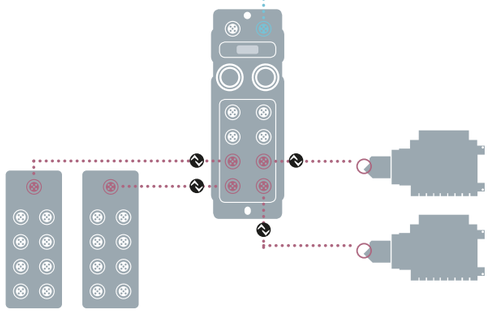
No matter what countries you are active in, with IO-Link there is one concept for field installation for various markets: for Profibus, Profinet, Devicenet, Ethernet/IP, EtherCAT, CC-Link or CC-Link IE/Field.

To adapt the bus system, simply change out the master and you can continue working seamlessly with virtually the identical schematics – without any added effort.

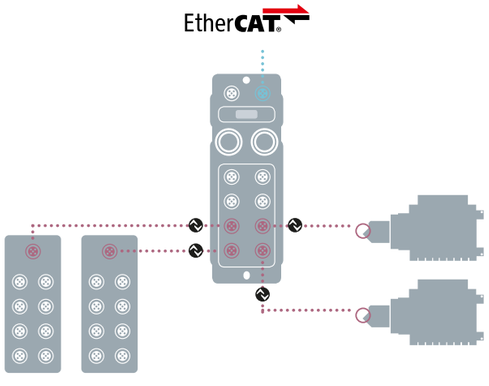
PROFINET®



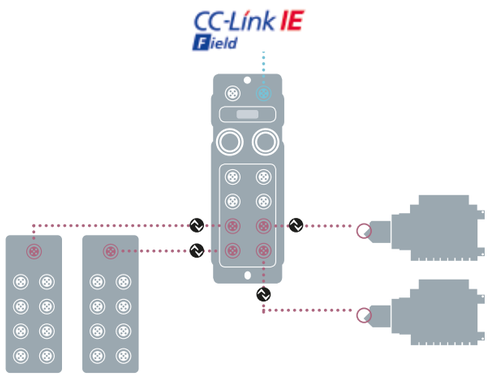
EtherNet/IP



EtherCAT®



CC-Link IE Field



A simple M12 connection is all you need

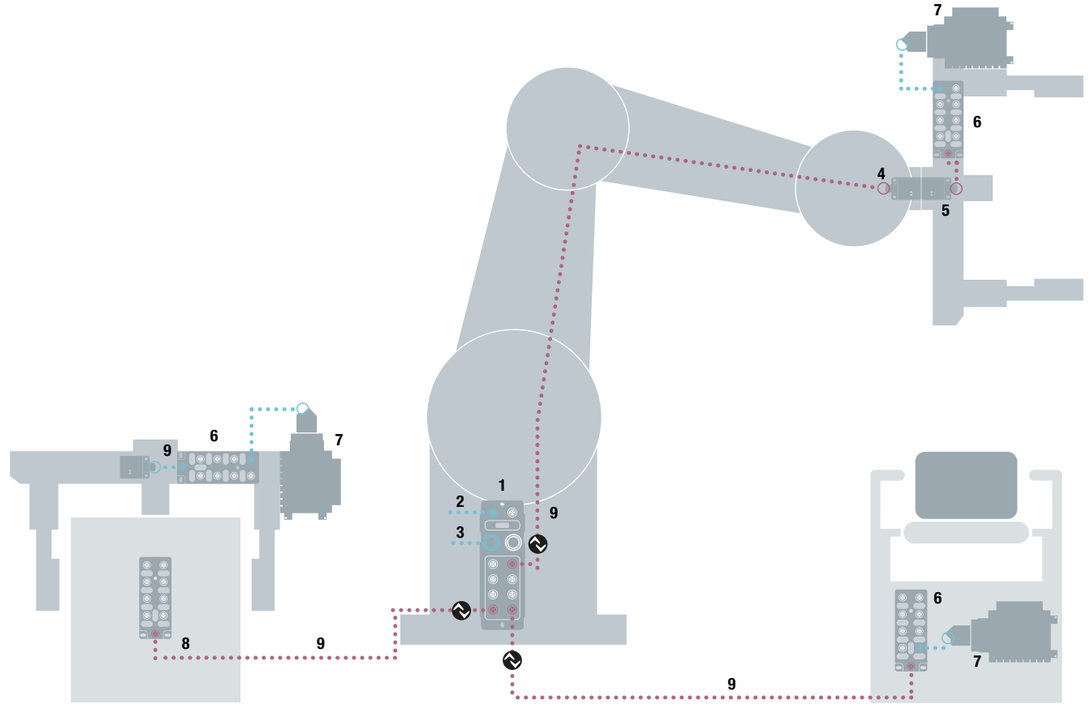
Automate Robots

Profit from minimal downtimes

Modern robot systems need many sensors – primarily in the robot arm. However, they should have less mass in order to ensure the dynamics and minimize the energy consumption. Furthermore, the expensive wiring of multiple cables makes it difficult to achieve high efficiency.

Thanks to IO-Link, difficulties like this are a thing of the past. This is because a standard M12 connection is all you need to ensure the function of the robot – no need for special connectors. I/O module and valve terminal are easily linked and complexity is reduced.

Inductive couplers provide you with quick tool changes because they send both data and power at the same time over an air gap. Plug-and-play makes for prompt connection of the new tool and is automatically parameterized by the controller via IO-Link. You no longer struggle with cable breaks, but rather profit from high flexibility and from minimal downtimes.



1 IO-Link master
2 Fieldbus cable
3 Power cable, 7/8”
4 Inductive coupler, 40 × 40 mm, Base, IO-Link, bi-directional
5 Inductive coupler 40 × 40 mm, Remote, IO-Link, bi-directional
6 M12 sensor hub, configurable, I/O with expansion
7 IO-Link valve interface (Festo, Bosch Rexroth)
8 M12 sensor hub, 16 inputs, PNP
9 Single-ended cordset, M12 → M12, 4-conductor

Expand decentralization

Consolidate and Gather I/O Signals

Minimize critical installations

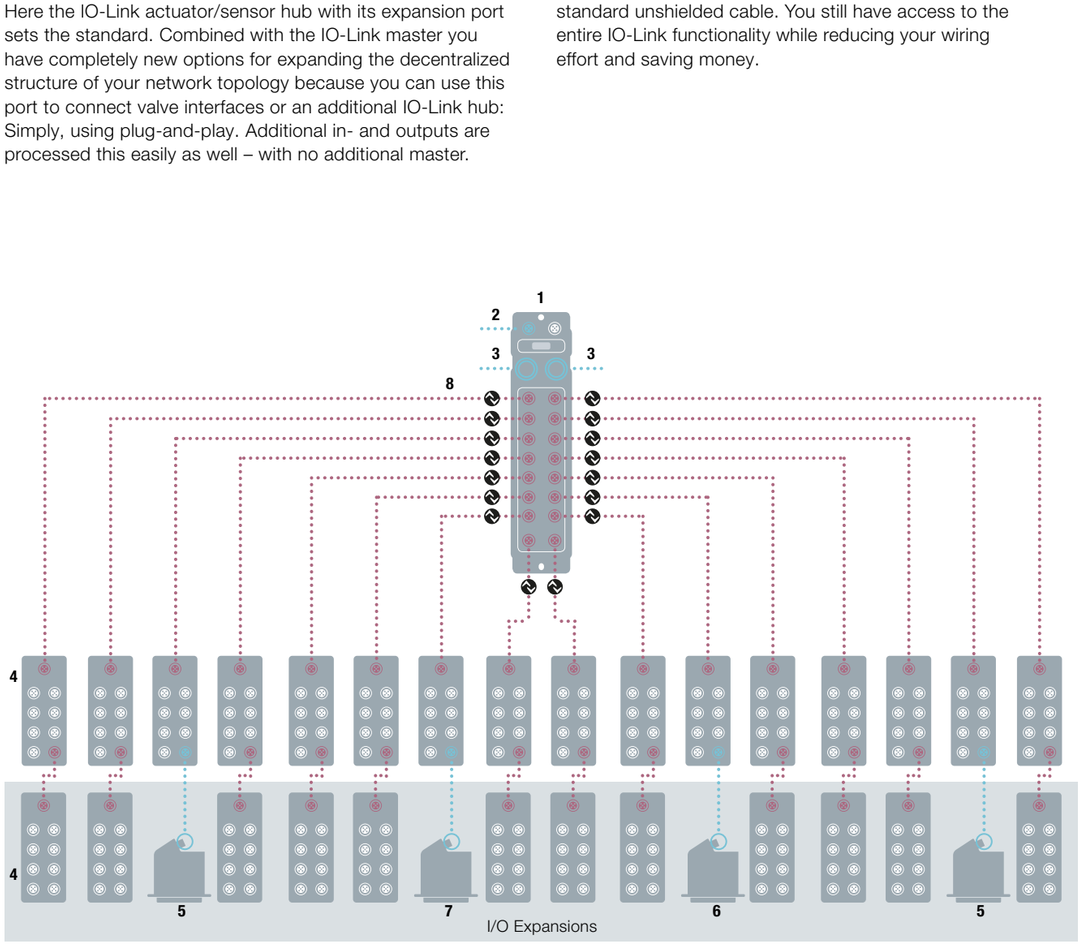
With IO-Link, you need only a node/IP address to transmit the data of up to 496 inputs/outputs. With the compression of the data, you preserve the valuable addresses and minimize critical installations.

Here the IO-Link actuator/sensor hub with its expansion port sets the standard. Combined with the IO-Link master you have completely new options for expanding the decentralized structure of your network topology because you can use this port to connect valve interfaces or an additional IO-Link hub: Simply, using plug-and-play. Additional in- and outputs are processed this easily as well – with no additional master.

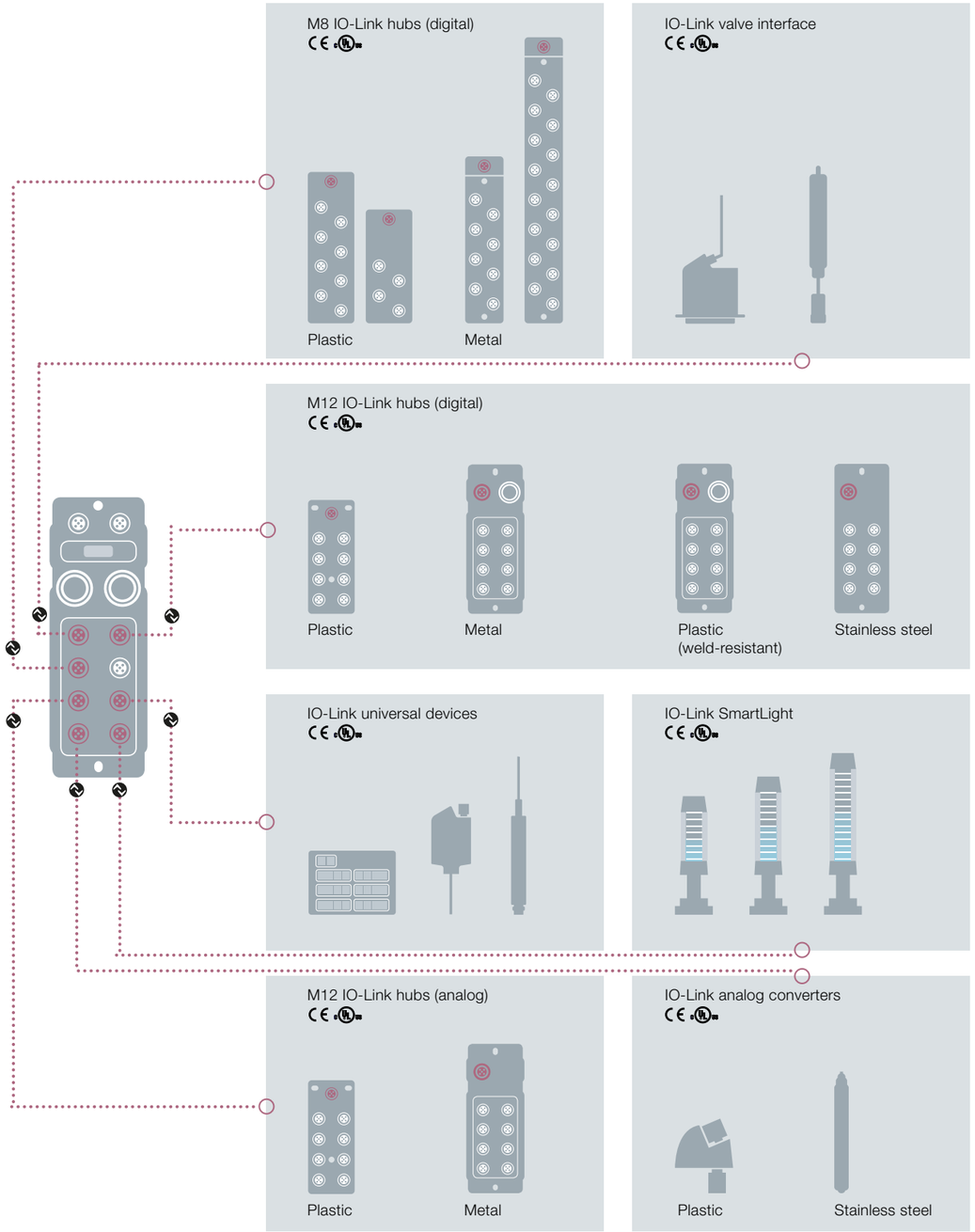
Configure up to 496 I/O's

A 16x IO-Link master allows up to 496 I/Os to be configured. The range is doubled and exponential cost savings are realized.

All you need to implement this network structure is a standard unshielded cable. You still have access to the entire IO-Link functionality while reducing your wiring effort and saving money.



1 IO-Link master
2 Fieldbus cable
3 Power cable, 7/8"
4 IO-Link sensor hub, configurable, I/O with expansion
5 IO-Link valve interface (Festo, Bosch Rexroth)
6 IO-Link valve interface (SMC, Parker, Norgren)
7 IO-Link valve interface (Numatics)
8 single-ended cordset, M12 → M12, 4-conductor



Maximum transparency for the optimal process

Track Data

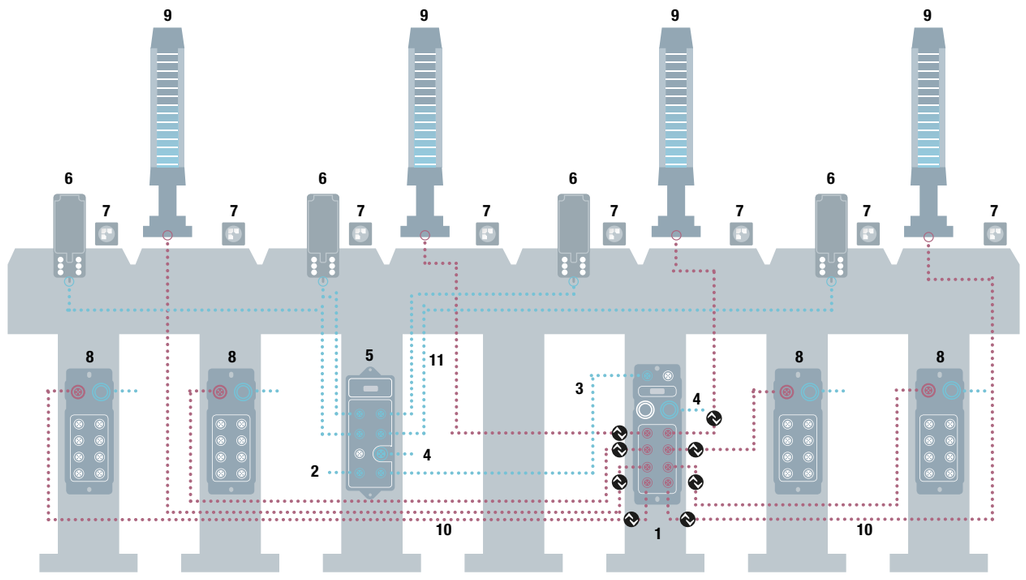
Ensure quality

The intelligent combination of RFID and sensors with IO-Link makes it possible to cost-effectively handle your identification requirements and process signals at the same time.

When is comes to quality assurance, RFID systems record the entire production sequence and make it traceable in real time. The data are documented directly on the workpiece or pallet, regardless of ambient conditions, read distances or technologies (low-frequency – LF, high-frequency – HF, ultra-high frequency – UHF).

Depending on the data volume and speed, we offer different devices: BIS V processor units for fast processing of high data volumes – and if you want to run LF, HF and UHF read/write heads simultaneously, the BIS V lets you process all these RFID technologies at the same time.

An IO-Link master is appropriate for standard ID tasks to connect I/O units or IO-Link capable sensors/actuators. Each individual production step, for example, can also be displayed using the SmartLight tower light.



1 Profinet, 8 × IO-Link master
2 Profinet cable, M12 → RJ45, shielded
3 Profinet cable, M12 → M12, shielded
4 Power cable, 7/8”, 4-conductor
5 Industrial RFID, Profinet processor unit 4x, 1 × IO-Link master
6 Industrial RFID, read/write head
7 Industrial RFID, data carrier
8 M12 sensor hub (metal), 16 I/O, configurable
9 IO-Link SmartLight, 3 segments
10 Single-ended cordset, M12 → M12, 4-conductor
11 RFID single-ended cordset, M12 → M14, shielded, 4-conductor

Correctly feed process media

Measure, Control and Regulate

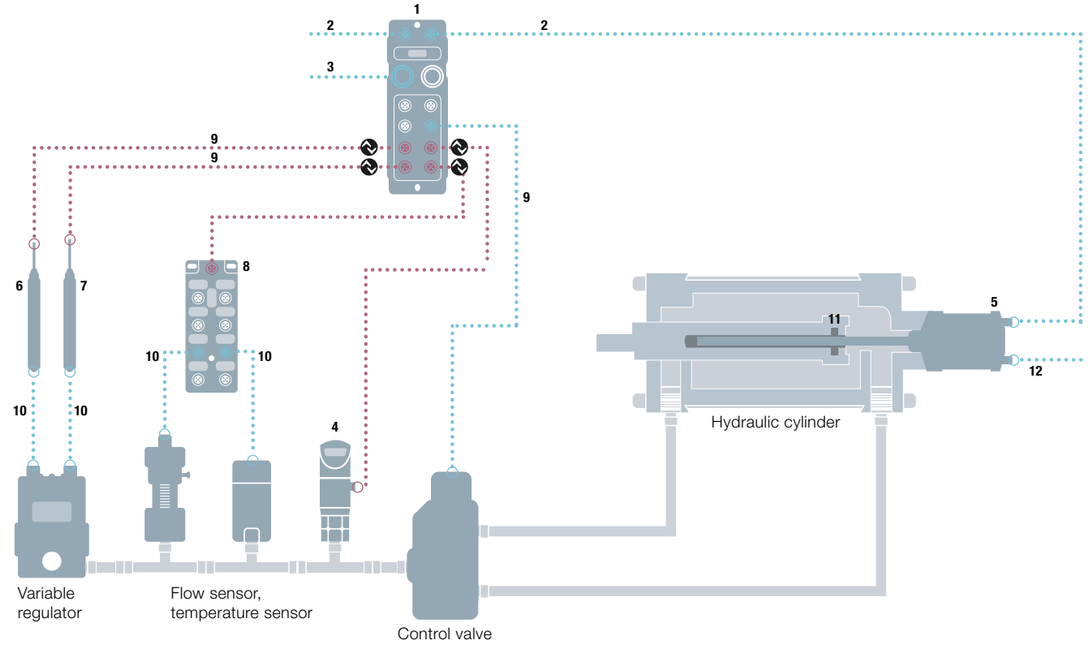
Example with oil supply for a hydraulic cylinder

IO-Link and simple unshielded standard cables ensure correct feeding of your process media. All you need is an IO-Link master to receive and pass along the data. So you only use one bus address for the entire control circuit of the master assembly.

For example, for the oil feed of a hydraulic cylinder you can fully automatically measure, control and regulate all the relevant components – pressure-, temperature- and flow sensor, control valve and the hydraulic cylinder itself which ensures the optimum oil flow.

The sensors measure the flow, temperature and pressure of the oil. These data are continuously passed to the variable regulator through the master, with the regulator comparing the data with the nominal value, initiating – if necessary – a readjustment and providing feedback to the controller.

Correct control of the hydraulic cylinder by the control valve is now possible. The master also passes this information to the controller, which in turn generates the positioning commands for the hydraulic cylinder. These commands in turn arrive where they are needed through the master. A great feature: you can wire the entire control circuit with unshielded, 3- or 4-conductor cables.



1 Profinet, 4 × IO-Link master
2 Profinet cable, M12 → M12, shielded
3 Power cable, 7/8”, 4-conductor
4 IO-Link pressure sensor
5 Profinet transducer BTL7, Length max. 7620 mm
6 IO-Link- analog converter, input 0...10 V DC
7 IO-Link analog converter, output 0...10 V DC
8 M12 sensor hub, analog 0...10 V DC, digital
9 Single-ended cordset, M12 → M12, 4-conductor
10 Single-ended cordset, M12 → M12, shielded, 4-conductor
11 Magnet for transducer
12 Power cable, M12, 4-conductor

Continuous diagnostics of the operating states

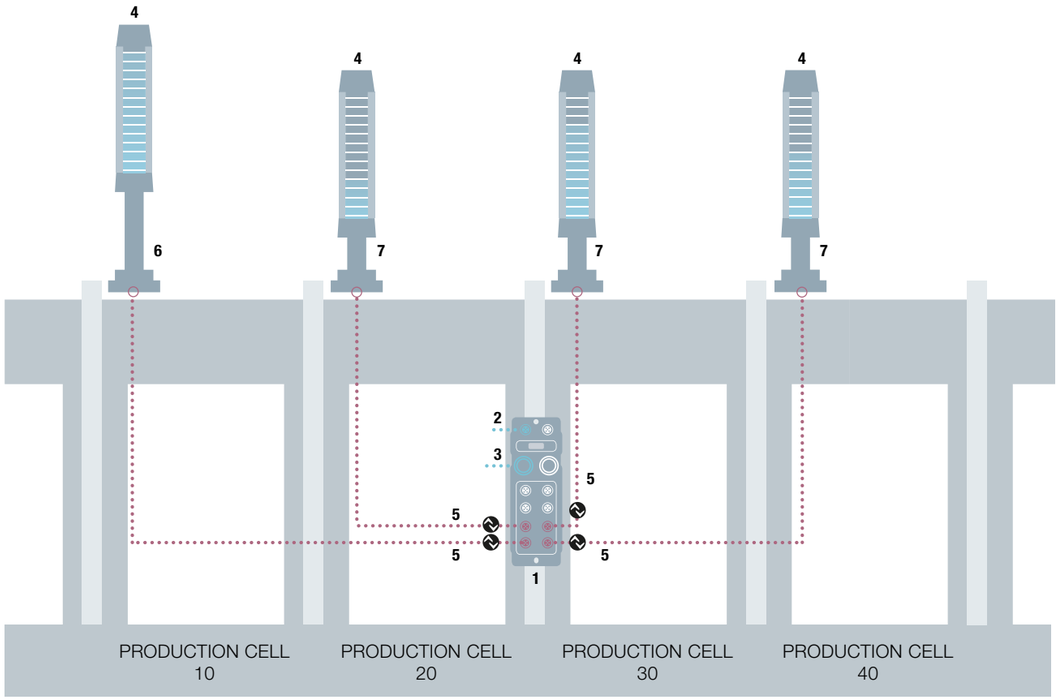
Signaling

Setup without mechanical reconfiguring

If you need seamless visualization of the production sequence on your production line, the SmartLight signal tower light provides the perfect solution. The SmartLight displays trends and tendencies, so that you can continually monitor various stages. This optimizes cycle times and gives early indication of any possible bottlenecks or maintenance duties.

The various modes – run light, stack light and level mode – can be set without making any mechanical changes. Use the controller to choose between Running Light and Color Gradient or the display of up to five color segments.

Just as important: the SmartLight is simple to retrofit.



1 IO-Link Master
2 Fieldbus cable
3 Power cable, 7/8”
4 IO-Link SmartLight, 5 segments and buzzer
5 Single-ended cordset, M12 → M12, 4-conductor
6 Stand for SmartLight, 400 mm high
7 Stand for SmartLight, 100 mm high

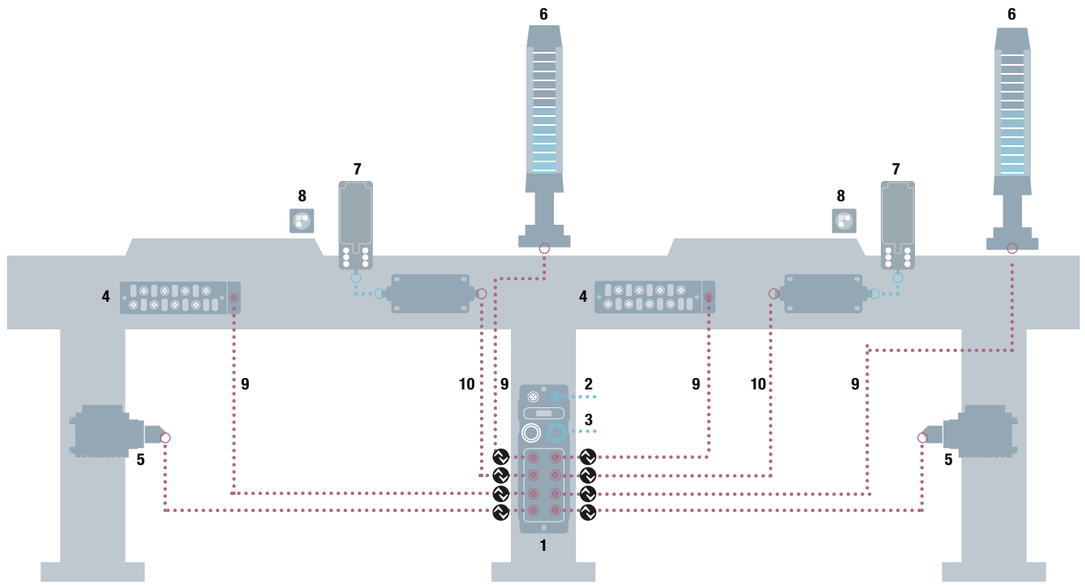
A network distributor for complex tasks

Handling and Assembly

Modules reducible

Whether you are bundling signals, switching pneumatics, recording and tracking data or want to display operating conditions with the SmartLight signal tower light – one network distributor used as a remote data compressor handles such complex tasks: all the analog functions, RFID applications, the valve control, signaling and the use of remote I/O.

One IO-Link master per production segment is all you need. In this way you can reduce various modules and select and deselect equipment options. This affords you great flexibility and saves you cash. At the same time an IO-Link master is extremely powerful. It scores additional points by virtue of additional features like a display, integrated switch and web server, which make it especially user-friendly.



1 IO-Link master
2 Fieldbus cable
3 Power cable, 7/8”
4 M8 sensor hub, 16 inputs, PNP
5 IO-Link valve interface (Festo, Bosch Rexroth)
6 IO-Link SmartLight, 3 segments
7 Industrial RFID, read/write head
8 Industrial RFID, data carrier
9 Single-ended cordset, M12 → M12, 4-conductor
10 RFID single-ended cordset, M12 → M14, shielded, 4-conductor

In the entire production process

WE SPEAK IO-LINK

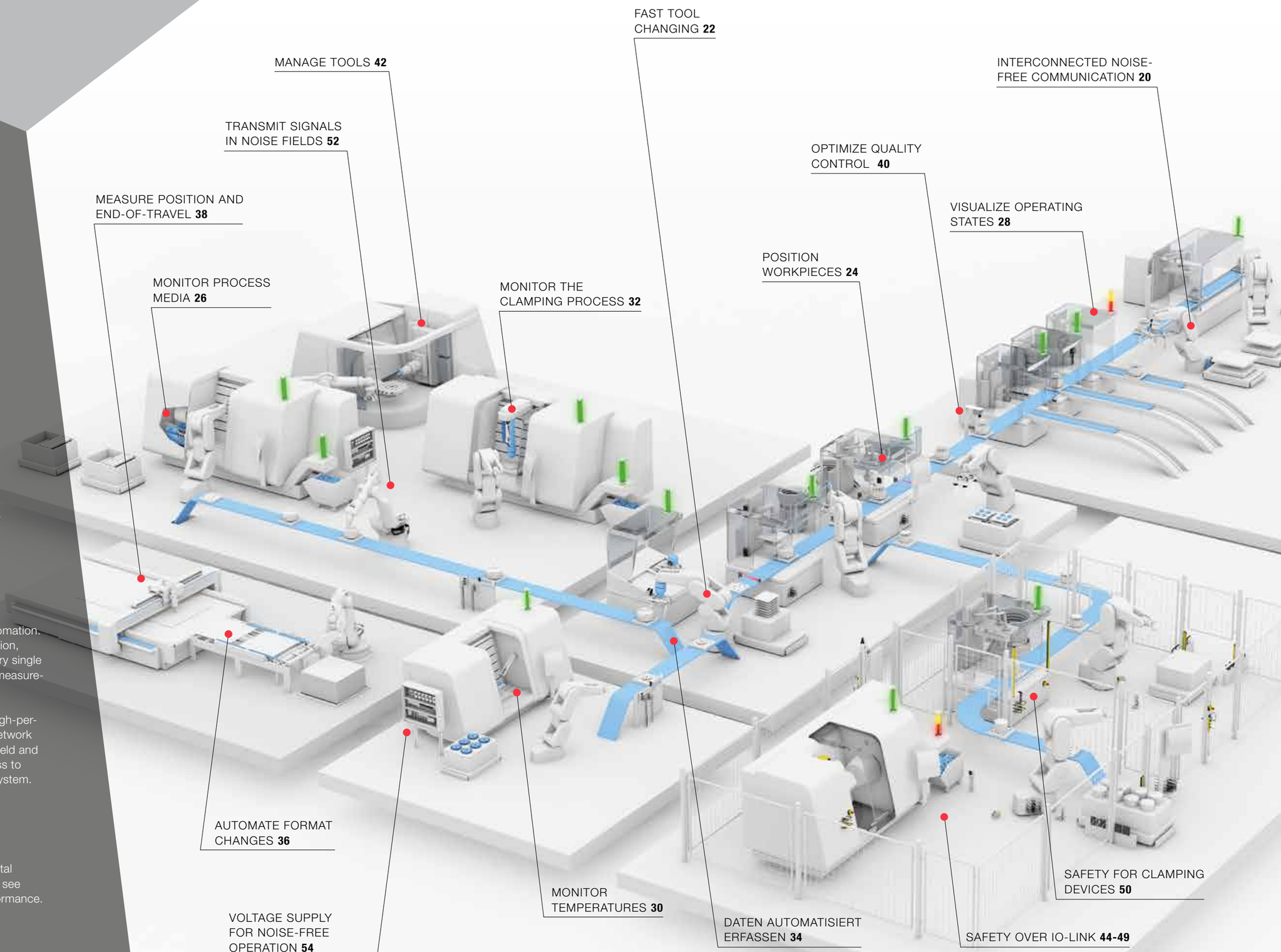
innovating automation

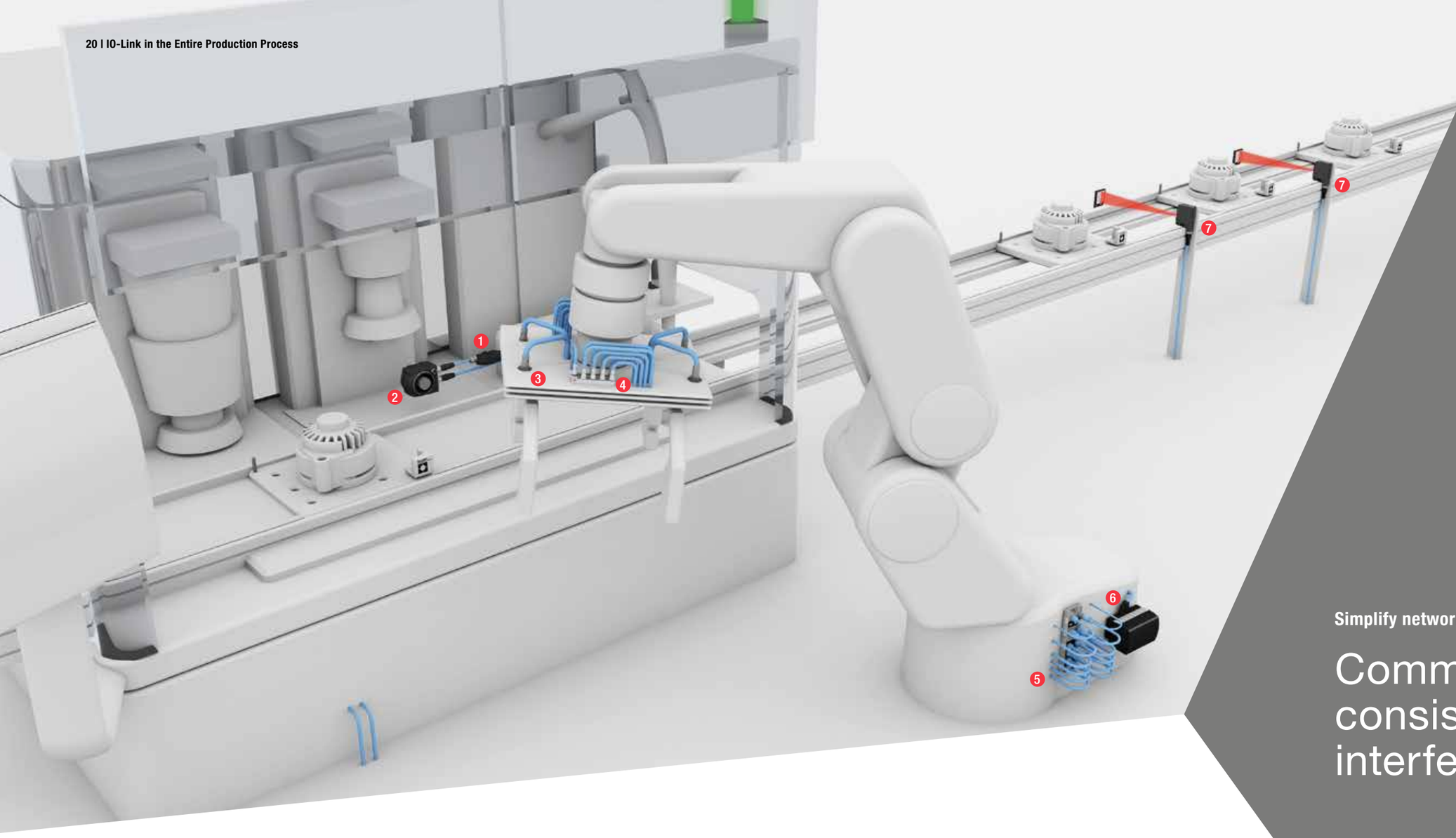
Balluff IO-Link ensures transparency for all of automation. In every area – whether logistics, service, production, assembly, inspection and packaging. And for every single application – whether fluids, identification, travel measurement or object detection.

At Balluff you get holistic IO-Link solutions with high-performance IO-Link sensors and the best IO-Link network and connectivity. Balluff speaks IO-Link in every field and with all principles of operation, so you have access to these IO-Link advantages throughout the entire system.

- **Easy to install**
- **Requirements-based maintenance**
- **Efficient operation**
- **Highest machine availability**

This lets you exploit all the possibilities of this digital communication standard. In the following you will see specifically all the ways you can use IO-Link performance.





Simplify network topology

Communicate consistently interference-free

All devices become IO-Link capable

Modern robotics equipment requires many sensors – especially in the robot arm which, because of the dynamics and energy consumption, still needs to have as little mass as possible. Another difficulty is the cumbersome wiring of multi-conductor cables.

Not so with IO-Link because this digital communication standard requires only a traditional industrial cable which is simple to install. IO-Link also ensures noise immunity with intelligent devices without the need for shielded cables.

Whether Profibus/Profinet over CC-Link/CC-Link IE-Field, Devicenet or Ethernet/IP and EtherCAT – our IO-Link masters let you use IO-Link with any controller. After all, IO-Link is fieldbus-neutral. With IO-Link you can bring a wide variety of devices together in this structure, so that even the most complex tasks including robotics and beyond can be simply mastered with the greatest possible flexibility.

The universal IO-Link interface integrates intelligent devices into the controller. Likewise you can also integrate standard analog sensors into the controller using our IO-Link analog converters. Or simply connect them to our IO-Link hubs, which can digitize the analog input signals and pass them on to the IO-Link master. With the IO-Link master you can also control actuators and valve terminals. Simply use the valve interface to connect the valve terminal to the IO-Link master. Here again all you need is a standard cable to make use of the full functionality.

A Balluff IO-Link sensor hub bundles the signals from up to 16 sensors or actuators. A special highlight are our cascadable hubs with expansion port to which you can connect an additional sensor hub or a valve terminal. If these hubs are cascaded with an additional hub and connected to our 16x IO-Link master, a module transmits up to 496 inputs/outputs.

1. **Universal IO-Link interfaces**
2. **Vision sensors**
3. **IO-Link ultrasonic sensors**
4. **IO-Link sensor/actuator hubs**
5. **IO-Link masters**
6. **IO-Link valve interface**
7. **Photoelectric IO-Link multifunction sensors**

Contactlessly transmit power and data

Fast Tool Changing

Maximum flexibility since the robot radius is increased to 360 degrees

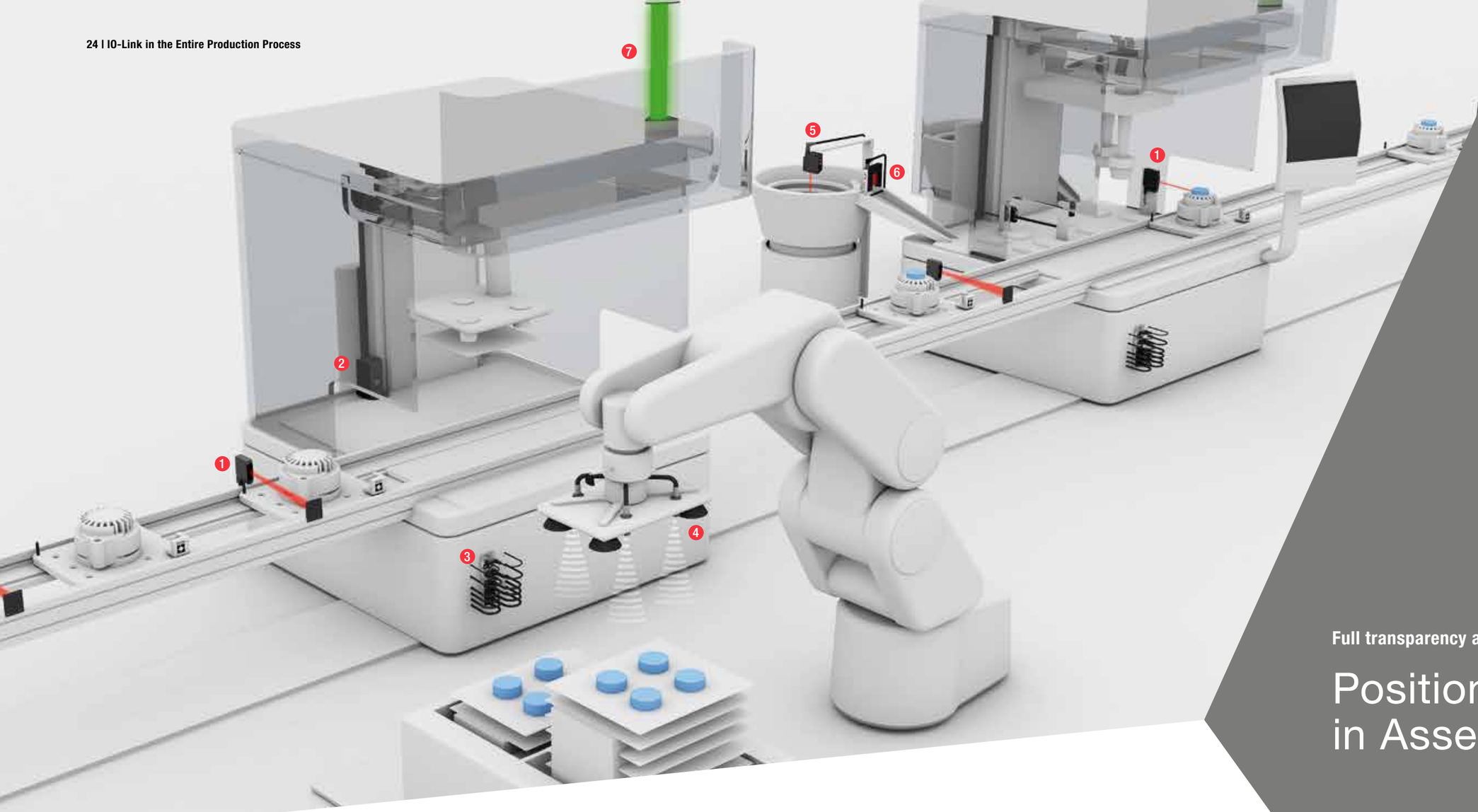
Inductive couplers are a windfall for robotics because they send both data and power at the same time over an air gap. How do you benefit? Greatly, and in many ways. Now the risk of cable breaks is fully precluded. Mechanical contacting of mechanical connectors is eliminated, and the robot has a continuous radius of movement of 360 degrees.

Our inductive couplers with IO-Link guarantee you fast gripper changes and increase the up-time of your system. This is because the signal is transmitted directly following the gripper change so that production can continue without interruption. The speed and flexibility support frequent format changes. The result is that you can produce even small batches efficiently. Another attractive feature: no mechanical wear means inductive couplers are maintenance-free.

The quick-disconnect units provide the greatest flexibility for your machine design. Even hard to access components are simple to connect with IO-Link. This is because all IO-Link capable devices now connect to the IO-Link master and to the controller flexibly and without contact.

The bi-directional inductive data couplers allow the data to be sent in both directions, and you can simultaneously control actuators and valve terminals while collecting signals. These variants support the full IO-Link functionality so that intelligent sensors and actuators can be configured and diagnosed without contact.

1 **Inductive couplers (style Q40)**
2 **IO-Link SmartLight**



Full transparency all the time

Position Workpieces in Assembly

Smart diagnostics increase reliability

When it comes to Industry 4.0, generating, transporting and processing information are indispensable parts of the process. This makes local intelligent sensors all the more important. Our photoelectric multi-function sensors detect actual operating states while collecting and processing information. And via IO-Link they provide far more data than just the switching signal.

The BOS 21M ADCAP multi-function sensor with red light is ideal for optimally positioning your workpieces for assembly. For the best functionality as required, you can use IO-Link to conveniently select between four different sensor modes. This allows you to utilize the best and most reliable detection method depending on your application.

The sensor simultaneously sends diagnostic data as well. Now you can evaluate the light emissivity value provided and detect increasing contamination of the sensor. In this way maintenance and cleaning schedules can be designed so that the sensor is always cleaned at just the right time before failures can occur. You also know whether the sensors are still optimally adjusted after a cleaning.

The BOS 21M ADCAP can do even more: it continuously monitors light intensity and brightness of the LED emitter beam so that faulty switching of the sensor is virtually eliminated. The built-in count function with various counting and reset modes also allows the quantity to be checked in the controller without any additional programming effort.

If your detection requirements are even more demanding, we offer our photoelectric High-Precision Laser BOS 21M HPL with numerous additional functions. Thanks to various detection and processing modes, this high-performer also detects complex objects and the smallest details with absolute precision.

1. **Photoelectric IO-Link multifunction sensors**
2. **Multiple position switches**
3. **IO-Link masters**
4. **IO-Link ultrasonic sensors**
5. **IO-Link color sensor**
6. **IO-Link fork sensor**
7. **IO-Link SmartLight**

For high production quality

Monitor process media

Plug-and-play sensor replacement: high machine availability

Pressure sensors are indispensable when you need to monitor process media such as coolants and lubricants, hydraulic fluids and pneumatics. The system pressure affects things such as the surface quality when processing workpieces. Continuous and exact regulation of the pressure is provided by our IO-Link pressure sensors, since they are continuously transmitting their measurement values and data to the controller.

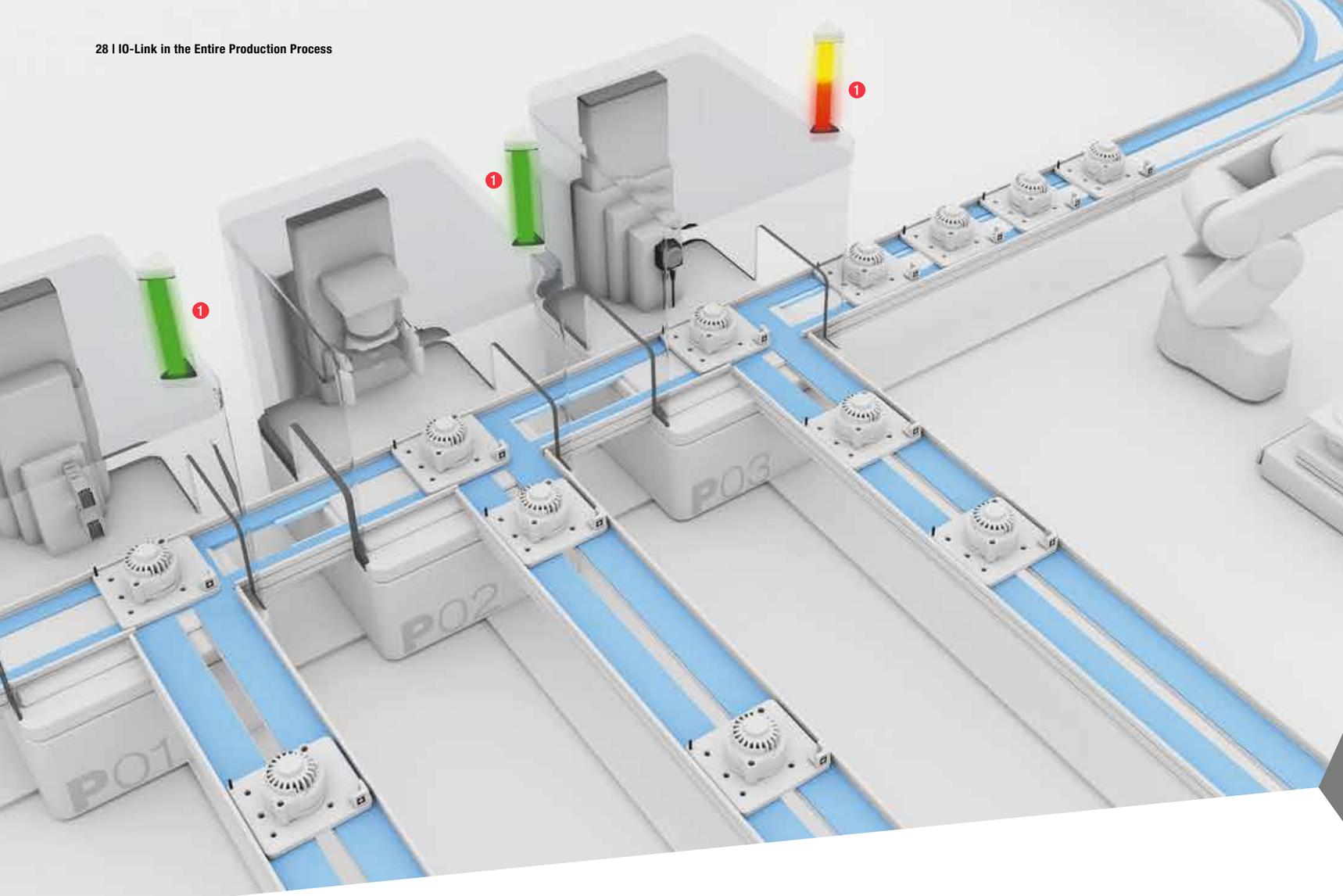
Pressure sensors also ensure the best results on a machining center. There they provide clamping distance monitoring to guarantee secure holding of the workpiece and tool in the lathe.

IO-Link pressure sensors are configured via the controller, so that they can be installed where the action is or in hard-to-reach places in the best position for measurements and perfectly matched to the machine design. This guarantees you fast and precise results and reduces your costs, since you can now reduce cumbersome mechanical installation of hydraulic lines to a minimum.

IO-Link pressure sensors ensure that you enjoy the greatest possible machine up-time. Replacing a sensor is plug-and-play, since the data for the replaced sensor are automatically loaded into the IO-Link master.

Depending on your requirements you can choose between IO-Link pressure sensors with display and IO-Link pressure transmitters without display. This ensures you of the best and most economical solution.

1 IO-Link pressure sensors



Greater flexibility was never easier

Simple visualization of operating states

One light. Many functions. Unlimited uses.

It's not yet possible to foresee all the demands of the Smart Factory. But to visualize your automation you can get a modern IO-Link device today that has virtually unlimited application and is ideally equipped for the future.

The LED stack light with IO-Link interface offers you a previously unimagined flexibility because with the Balluff SmartLight you can represent operating states in detail. In addition, you can even see trends and progressions. The SmartLight features three different modes.

Display a wide range of color signals in freely configurable segments (Segment mode). Color progression display for representing variables such as level, position or temperature (Level mode). And an automatic run light with freely programmable foreground and background color (Run Light mode).

The best part: You can change to any mode on-the-fly. Colors can also be changed while running because you configure the SmartLight simply from the controller. So forget the cumbersome mechanical reconfiguration of traditional stack lights. And in contrast to those older systems, you can individually specify the colors and zones for number, size and color definition.

Like all IO-Link devices, the SmartLight is simple to connect and install. A 3-conductor sensor cable is all you need to quickly connect it to your system and have immediate access to the full functionality.

1 IO-Link SmartLight
2 Inductive couplers (style Q40)

Reliable condition monitoring: high product quality

Constant temperatures for induction hardening

Sensor right where the action is

Whether you process your parts by annealing or induction hardening, our infrared temperature sensors will help give you full control over your quality because monitoring temperatures during the hardening process is extremely important for not damaging the workpiece and ensuring the required product quality. Our sensors in the rugged M30 stainless steel housing handle this job without contact and reliably. And at a temperature range of from 250 to 1250 °C. They detect hot objects even while moving. Our temperature sensors make it possible to significantly reduce the process time.

An important value in non-contact temperature detection is the emissivity. You can teach this with just a key press if you know the object temperature. This is usually simpler than exactly determining the emissivity values and adds the advantage that you can set the machine up in a much shorter time.

IO-Link lets you install the non-contact sensors just where they are needed, since you can configure all the functions and parameters remotely from the controller. Nor are any setting changes necessary at the sensor location when products are changed. The appropriate configuration sets can be updated and loaded at any time via IO-Link.

This communication standard enables consistent diagnostics. You can query the device status at any time through the IO-Link interface at the same time. In addition, the information provided by the sensor via IO-Link related to ambient conditions can be logged and documented including the temperature values for the hot workpieces.

1 IO-Link high-temperature sensors

Continual, non-contact linear position measurement

Monitoring the clamping process in the machine system

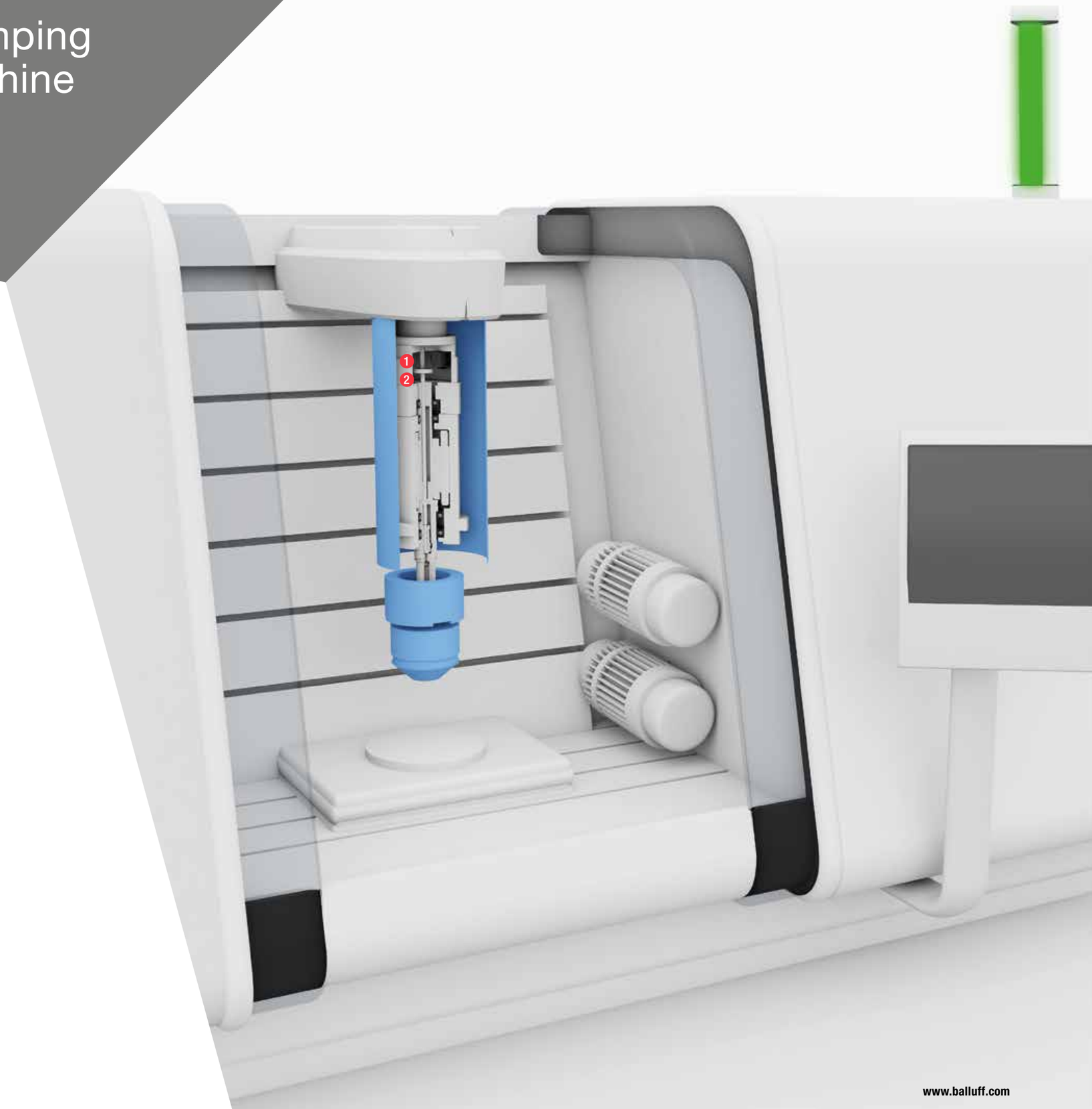
Greatest process security – even in a harsh industrial environment

Compact, precise tool spindles, clamping cylinders and tool changers on a machining center play a central role in the work process. This is why reliable and wear-free monitoring of the ongoing clamping process in the machine system is so critical.

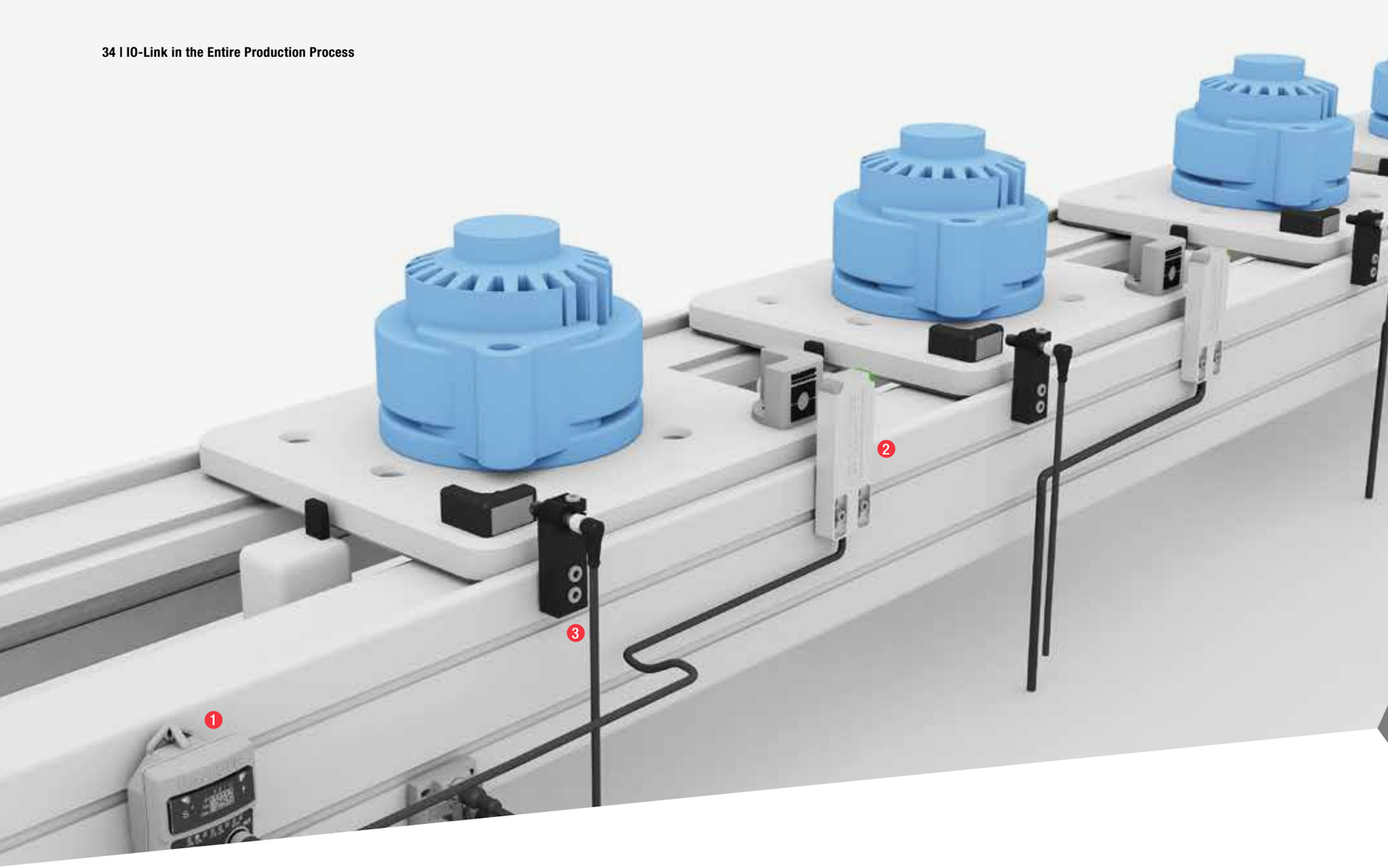
Meet this demanding challenge simply with the new IO-Link positioning system. It features an absolute measuring principle and transmits an additional Out-of-Range bit. This tells the controller that the target has left the measuring range, thereby increasing reliability. In addition, you can set up to three switching signals, and internal temperature detection is also possible. The high linearity and precise repeat accuracy of the measuring system give you reliable results.

At the same time, the non-contact measuring system in the fully potted housing will ensure the highest process reliability and automation quality even in the harshest industrial environments. Also advantageous here is the high level of electromagnetic compatibility. You can use our inductive IO-Link positioning system in many different ways thanks to its configurable measuring range. And the compact size means it can be installed even where space is at a premium.

Its digital IO-Link signal means the positioning system is guaranteed to be noise-immune even using unshielded cables. Thanks to IO-Link you can eliminate an analog input card.



1 IO-Link inductive positioning systems
2 IO-Link inductive distance sensors



ID complete solutions for transfer systems

Automatically Acquire Data

Increases product quality, optimizes the process

When your automation calls for parts tracking, there is no alternative to RFID because these self-controlling systems record and document all the data in real time. They make every single production step, every material used and each operating resource traceable, so that corrections are possible while the process is still running. This comprehensive transparency provided by RFID represents the prerequisite for process optimization while ensuring high product quality.

Our rugged BIS V processor unit provides fast data transmission, short cycle times and increased data security in all applications. This lets you use different RFID technologies – LF, HF and UHF – at the same time on a single processor unit. Just one type of processor unit is all you need to handle any application. Whatever industry you are in, this high-performer features perfect electromagnetic compatibility and works with all common bus systems.

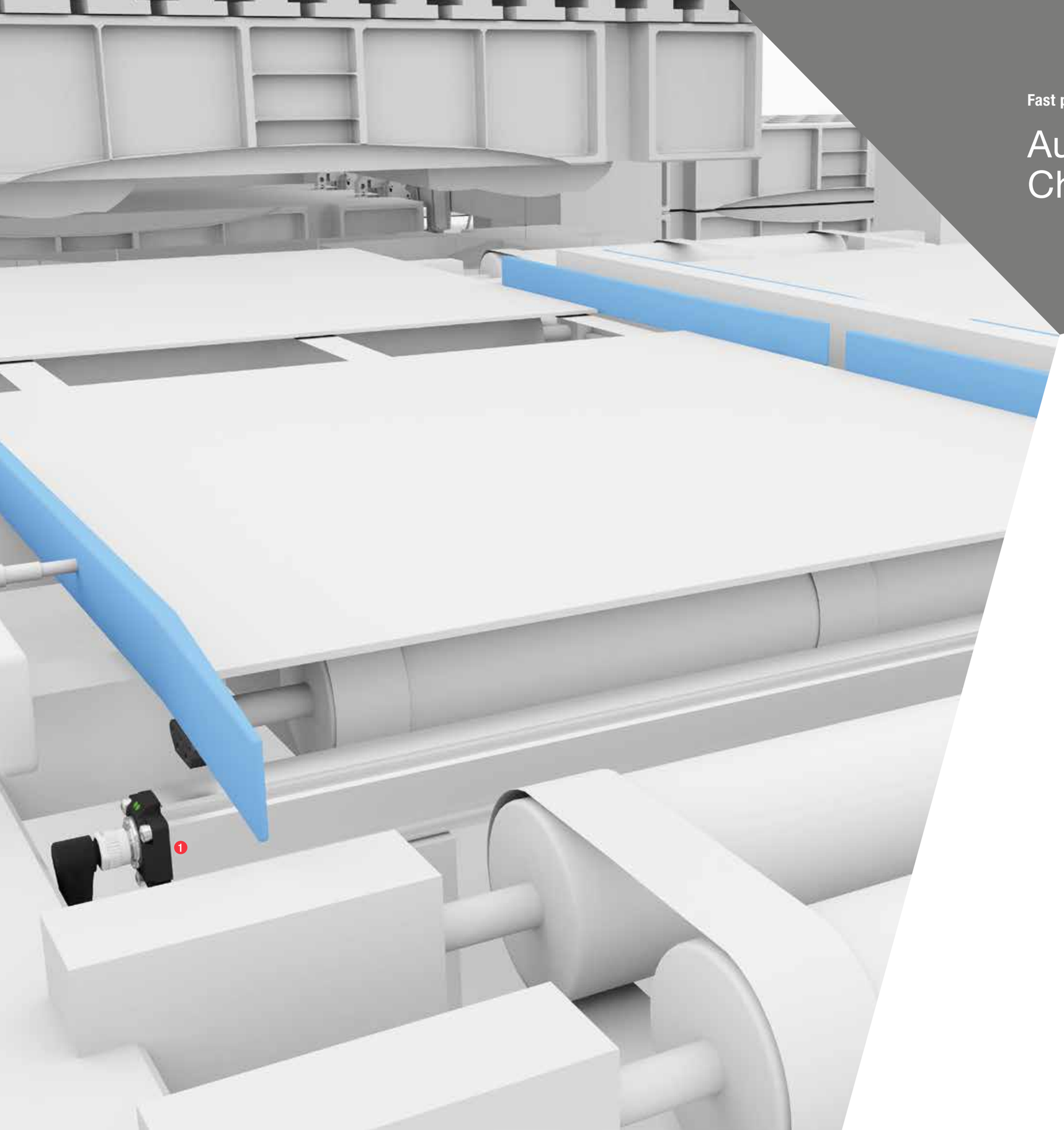
BIS V comes with four ports which can be individually configured and operated simultaneously with up to four read/write heads. In addition, you can connect IO-Link capable sensors and actuators or a sensor hub with up to 16 sensors to the integrated IO-Link master port. Now you can bundle sensor data in the simplest way possible in any network technology. Your network structure becomes more efficient, while you save time and money.

Alternately, you can use IO-Link ID systems. As easy to connect to the IO-Link master as a sensor, they require no processor unit. The bottom line: IO-Link makes parts tracking especially economical.

1 BIS V processor unit with IO-Link master
2 BIS L IO-Link read/write heads
3 BIS M-Link IO-Link read/write heads

Fast parameter replacement, minimum scrap

Automate Format Changes



React quickly and flexibly to changing requirements

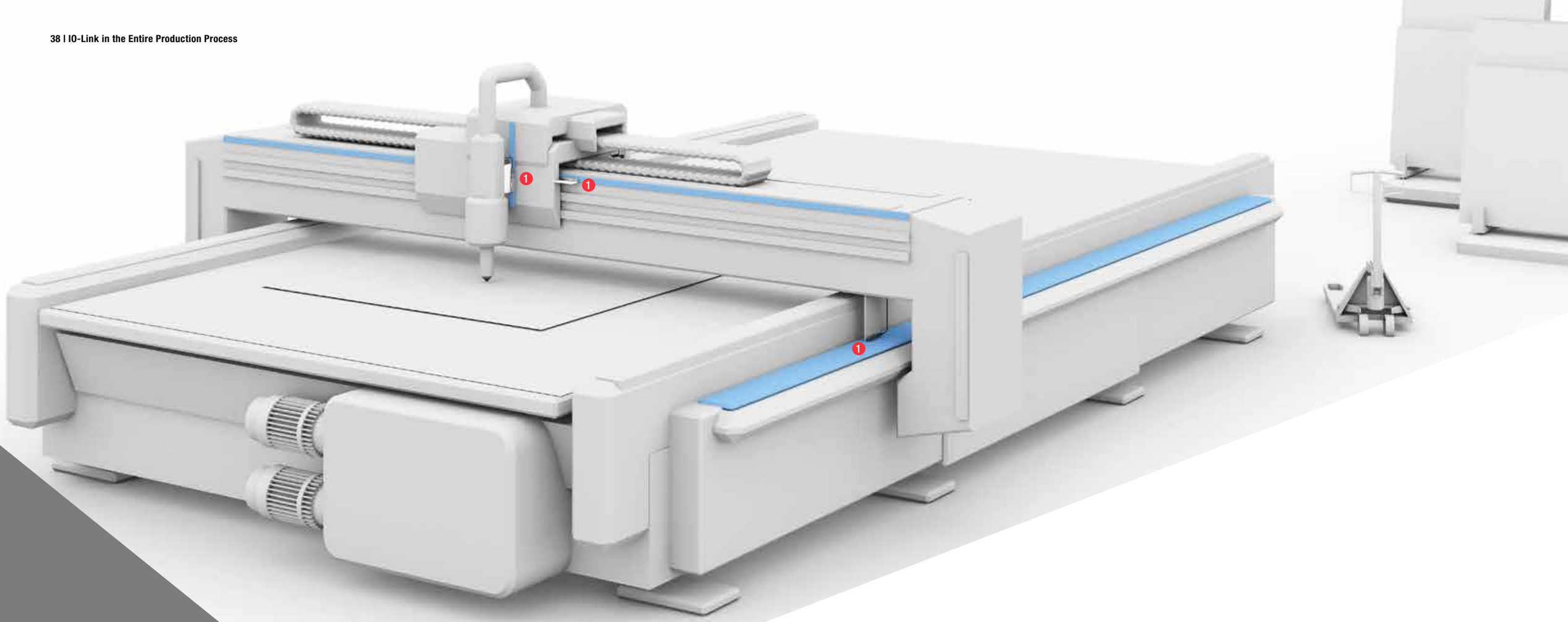
Ever smaller lot sizes mean your production has to be able to respond ever faster to changing customer demands. And in a flexible way, since different sizes and formats are involved in feeding, processing and packaging the material.

The position and spacing of the adjustment points such as transport belts and guide rails, therefore, need to be reset each time the product format is changed. Using position measuring systems for format changing shortens the change time, increases product quality and reduces scrap to a minimum.

Our magnetostrictive linear position sensors with IO-Link interface provide high-precision, fast and absolute position detection for your individual format settings. The rugged design with a hermetically sealed housing makes it completely impervious to contamination, shock and vibration. You will profit from high machine and system up-time even under extreme ambient conditions. Simultaneously querying multiple positions with a single positioning system saves you additional integration effort and cost.

IO-Link gives you multiple benefits: incorporation into the control system and replacing the parameters using the defined protocols is simple and time-saving. Plug-and-play makes system interchanging quick and easy. The system is up and ready again immediately with no homing move for a maximum stroke length of 4572 mm.

1 IO-Link magnetostrictive linear position sensors



Simple handling, versatile application – economical!

Measure position and end-of-stroke with absolute accuracy

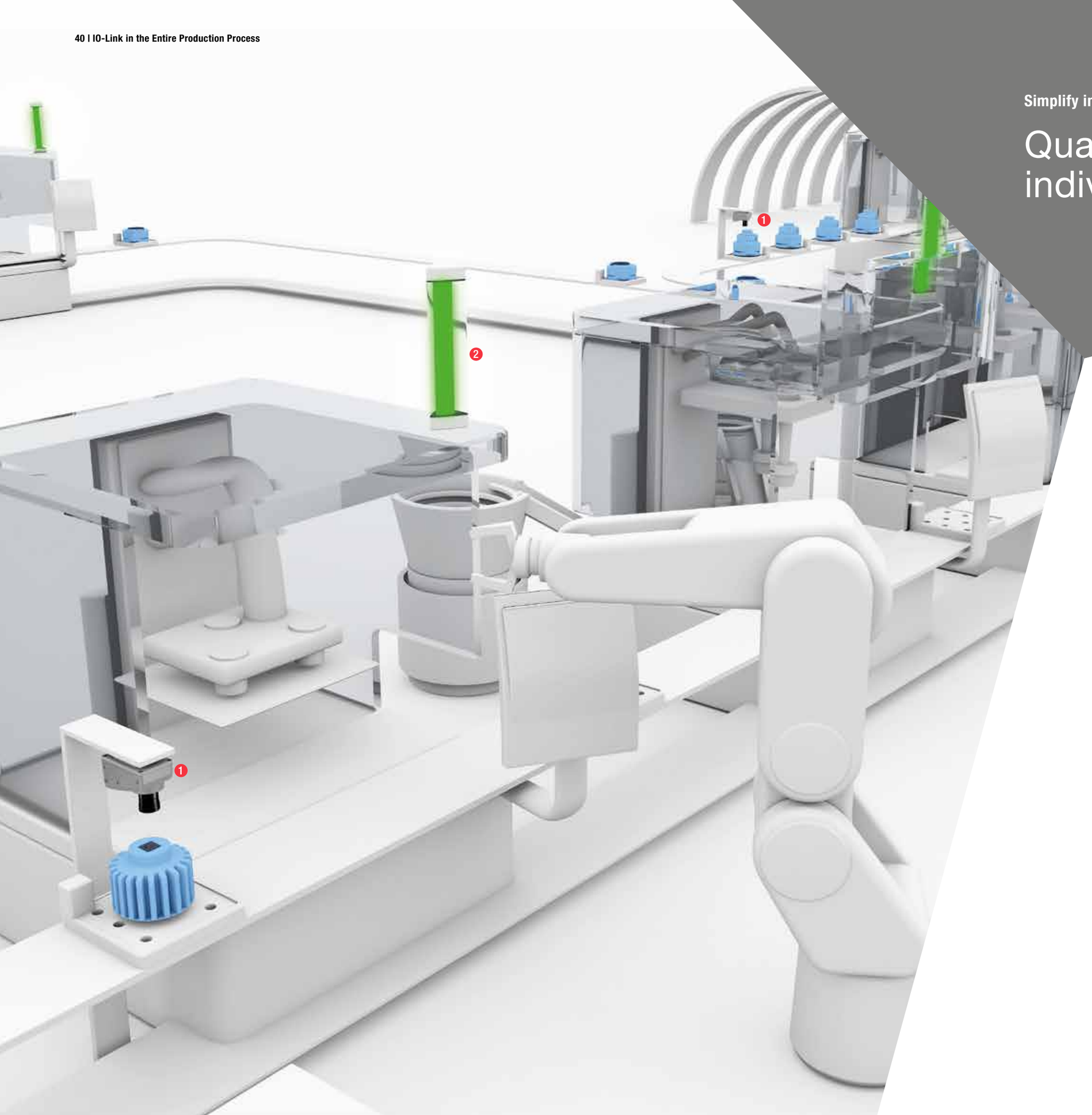
Continuously monitor position during movement

When other travel measuring systems are too large, too slow, too imprecise or too inflexible, you can count on the BML-SL1 absolute magnetic encoder. It stands out wherever you need high absolute accuracy of positions and end-of-travel. Specifically developed for measuring and positioning tasks, it is super-fast, highly precise and can be used in any industry. The encoder is compact, making it easy to integrate. It is simple to use and at the same time extremely cost-effective.

Special flexibility comes from its built-in IO-Link Interface. And not least, IO-Link allows you to conveniently connect the measuring system. Format setup and adjustment are also fast and easy using this communication standard because you can easily enter all the parameters from a central location. Using IO-Link you can output position information and easily view it on the controller. With IO-Link you monitor the target position and continually check positions during the move.

With the BML SL1 you get all the advantages of a magnetic tape system and the innovative interface of the controller world.

1 BML SL 1 absolute linear magnetic encoder system



Simplify industrial vision applications

Quality control to your individual specifications

Well-positioned for Industry 4.0

For modern, flexible manufacturing our SmartCamera with fieldbuses and IO-Link offers you a wide range of applications. It takes care of visual quality controls of the finished parts including their production steps by, for example, checking whether size, distance and orientation are correct or whether the parts are complete and flawless. This means you can discover and correct process errors early in each individual production step. The result is less scrap and reduced follow-on costs.

To ensure an optimal process the IO-Link interface allows additional sensors to be incorporated into the overall solution, so that with our camera you are well equipped to meet the challenges of Industry 4.0.

For example, through the IO-Link master interface you can also directly – without a PLC – display process control states using our IO-Link SmartLight stack light. The SmartCamera enables intelligent data management and provides for modern information storage. All the data are formatted as desired and passed on to the host control system.

The user-friendly interface ensures that all the tasks can be simply and quickly taught according to your individual specifications. The complete software with online help as well as graphical interface, tool aids and manual are already integrated. We think you should be able to take brilliant images for granted.

You also stabilize your entire production process with our SmartCamera because it can be configured so that only the information needed for the controller flows through the process network. All the other data are directed to a separate Gigabit Ethernet network. This minimizes data load and secures your process network.

1 SmartCamera BVS SC with IO-Link master
2 IO-Link SmartLight

Automated tool management with RFID

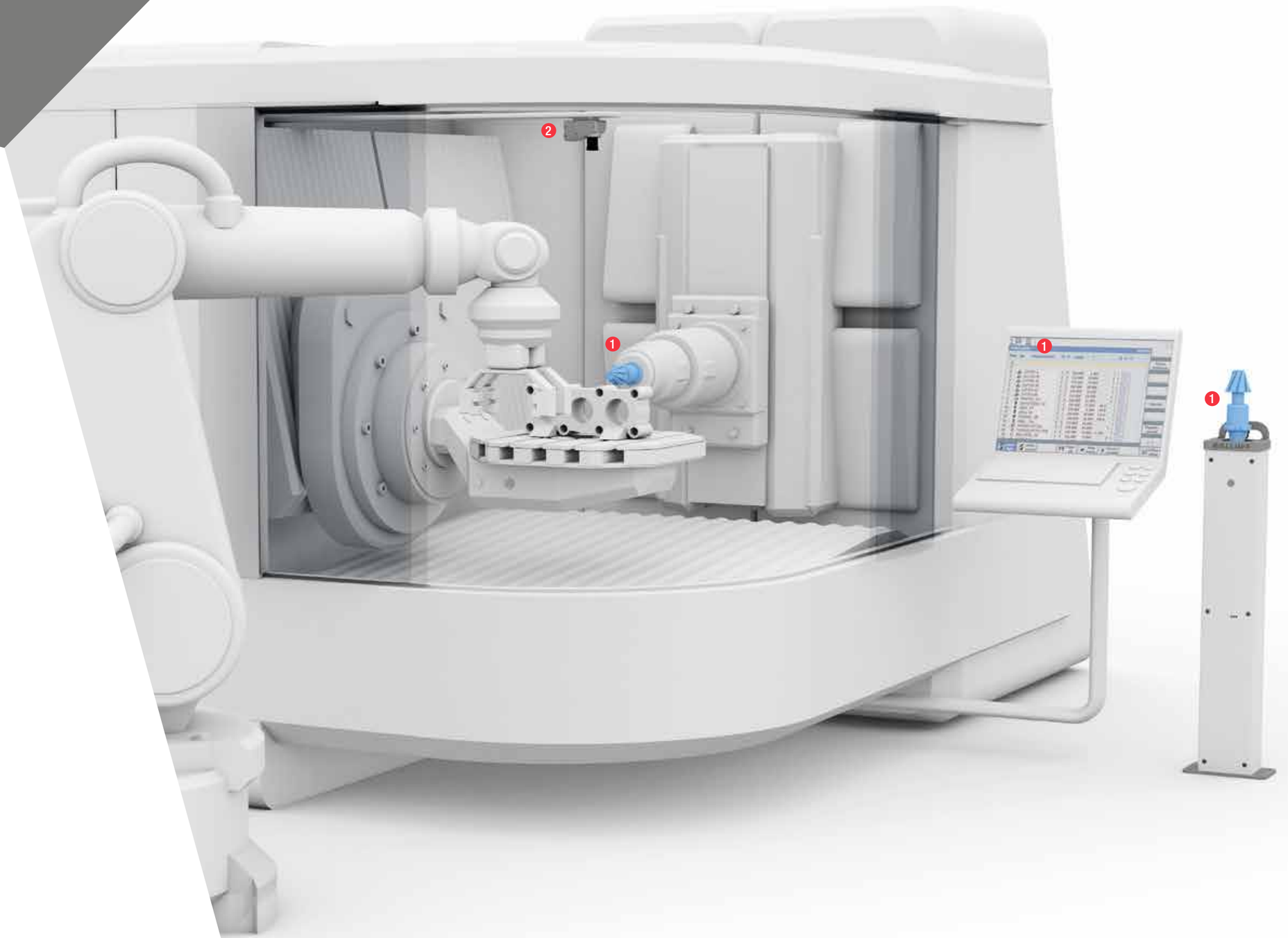
Automated Tool Management

All the tools at a glance

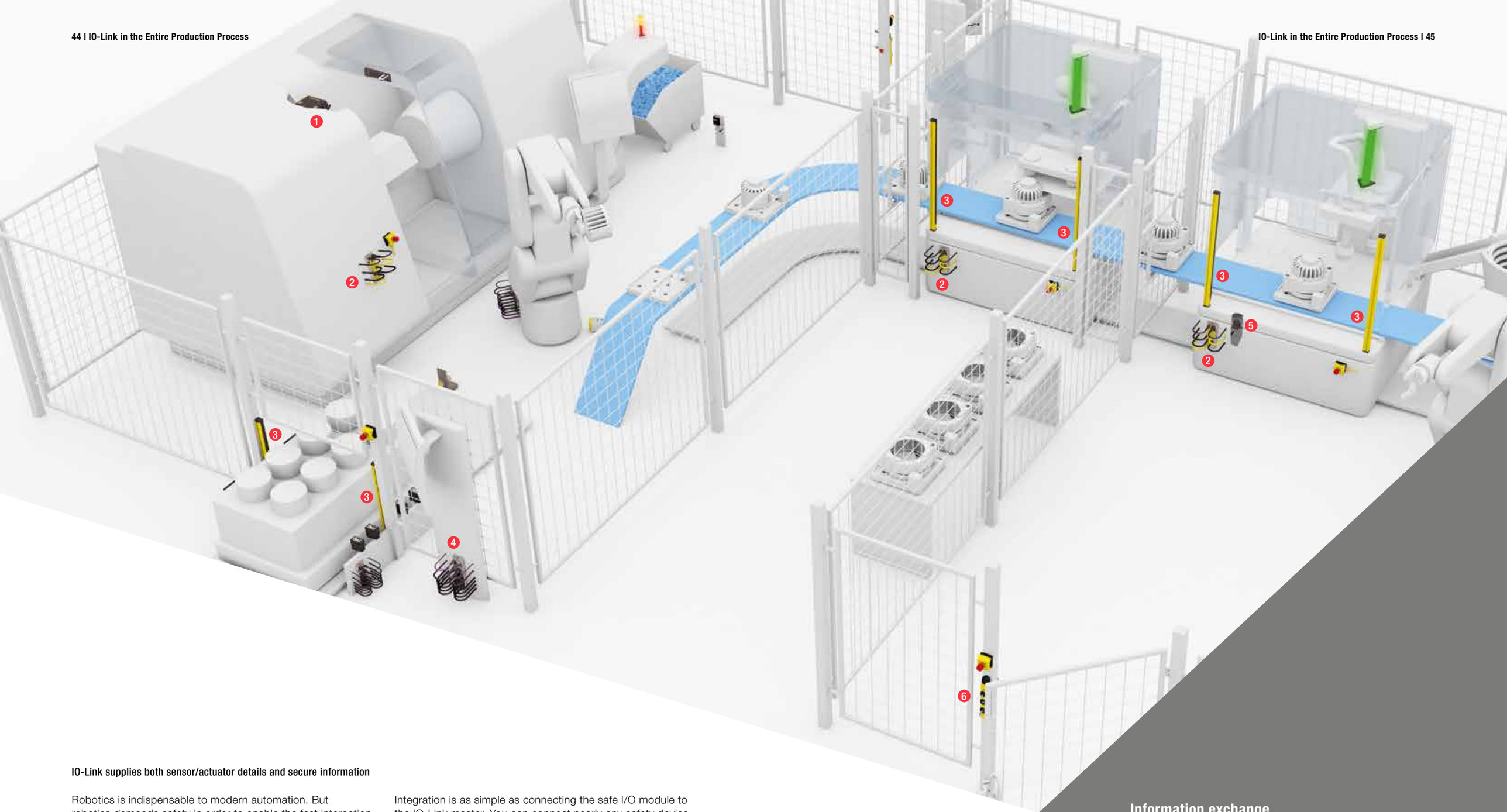
When it comes to industrial automation, rugged RFID systems from Balluff have for over 30 years secured the high quality of the tools used and their optimal utilization. We offer systems which always provide the correct tool data to the CNC controller in milling machines and machining centers.

With RFID the right tool can be assigned to the right machine for any upcoming process. Each individual tool is independently directed through production, checked and, if necessary, reworked and returned. RFID guarantees you unique unambiguous identification of every tool used, since the unique ID on the data carrier fixed to the tool holder is unmistakable. All tool-relevant data can be displayed via IO-link in the controller. This gives you high machining quality and optimal tool utilization. In this way RFID-assisted tool management contributes to greater value creation.

At Balluff you can choose from low-frequency (LF) and high-frequency (HF) systems which, thanks to the great variety of data carriers and read heads, lets you solve all kinds of applications even under challenging conditions. Our low-frequency BIS C has, over the years, established itself as a standard. With our high-frequency BIS M you can handle large data volumes. And if you need to work with both LF and HF, our solutions also provide reliable mixed operation of both frequencies. With Balluff you can choose a frequency-independent, cross-technology processor unit.



1 Easy Tool-ID
2 SmartCamera BVS SC with IO-Link master



IO-Link supplies both sensor/actuator details and secure information

Robotics is indispensable to modern automation. But robotics demands safety in order to enable the fast interaction between man and machine. Safety technology is thus a given for automation: only with it can, for example, fast applications with pick-and-place be realized.

With our concept you use solutions which will work precisely and safely over years. And the best part is that these are also quite easy to implement because safety technology from Balluff offers the advantages of IO-Link.

Safety over IO-Link is simple to integrate and reacts quickly. It communicates down to the last meter and provides both sensor/actuator details as well as safety information. This lets you realize reliable, flexible information exchange and data transport across all levels.

Integration is as simple as connecting the safe I/O module to the IO-Link master. You can connect nearly any safety device to this system, which is open all the way to the sensor level, and bundle the signals from binary standard sensors.
The parameterization is done centrally via the controller. The safety-relevant information is sent through the master to the controller.

1. **RFID interlocks**
2. **Safe IO-Link I/O modules**
3. **Opto-electronic protective devices**
4. **IO-Link masters**
5. **Transponder-coded safety sensors**
6. **Electromechanical safety switches**

Information exchange and data transport across all levels

Safety over IO-Link

For the fast interaction of man and machine

Safe Personal Protection

Economically securing hazardous locations

An economical solution for securing hazardous locations are our safety light curtains. These non-contact protective devices reliably detect fingers, hands or the body and stop all hazard-inducing movements of machines. In this way they ensure personal safety and eliminate the expense of guard fence constructions, so that you can better use the available space. At the same time, you profit from high anti-tamper protection. Simply connect the light grid to the safe I/O module that is connected to the IO-Link master. You have now produced the safety function while at the same time reducing costs because the connectivity is the familiar M12 standard.

To be able to reliably feed material to the robot, our safety light curtains can also be used at material locks so that the muting applications can be implemented. There the safety function is temporarily jumpered when the material is transported through the protective field. Safety is, however, still maintained in case a person inadvertently attempts to enter the hazardous zone.

In the worst case, you can use our E-Stop to trigger the stop command to stop the hazardous movement. Our E-Stop is simple to install and versatile in its use. Its compact housing makes it ideal for a wide range of machines and systems. Its high protection rating means it is impervious to dust and water.

1. Opto-electronic protective devices
2. Safe IO-Link I/O modules
3. E-Stop devices
4. IO-Link SmartLight

Wear-free and tamper-proof

Safety for people and systems

Direct querying of robot position and end-of-travel with metal

Our inductive safety sensors offer you safety for people and equipment. These detect the approach of metallic objects without contact and provide you with the needed safe signals for position or end-of-travel. Now you can safely monitor robots and workpiece carriers. Unlike traditional safety switches, inductive safety sensors require no special mating part. This is how easy it is to directly query robot position and end-of-travel of metallic workpiece carriers. Simply connect the sensors to the safe I/O module, which bundles all the signals and passes them to the processor through the IO-Link master.

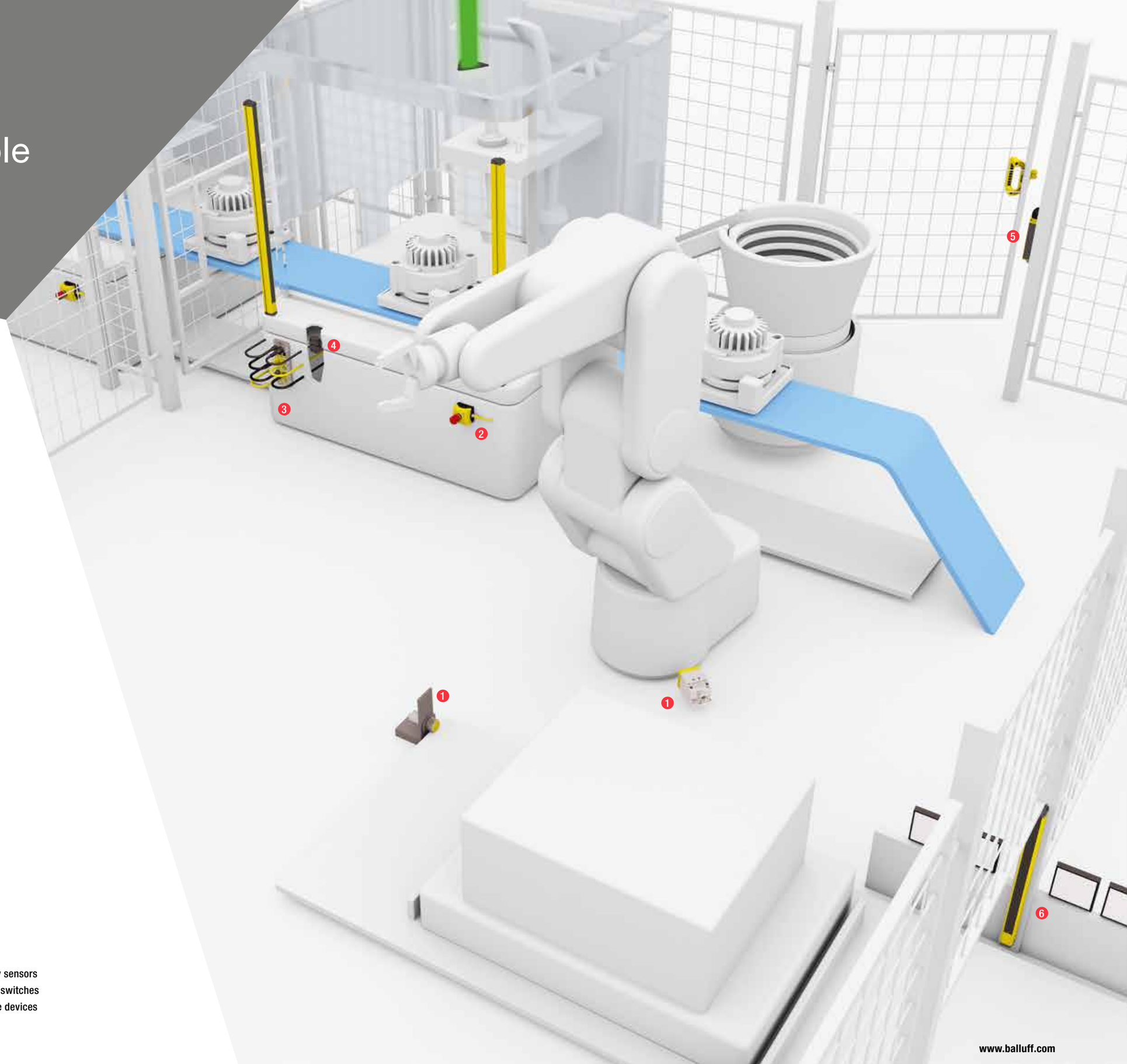
An economical solution to access security

Our REED safety switches ensure wear-free access security. This economical solution is insensitive to door shifting and is highly rugged. Another plus: The spacer even makes it possible to install in ferromagnetic surroundings.

When there is strong vibration

If it's higher demands you have to meet, transponder coded safety sensors are indispensable. Our RFID safety sensors ensure safe monitoring of guard doors which are subjected to strong vibration. You enjoy the benefits of both high coding levels and high anti-tamper protection because the passive RFID transponders are uniquely identifiable.

The contamination-resistant sensors, with a generous detection range, are ideal when doors settle or are imprecisely guided. Which also means they offer great room to play for installation. And to save on door fittings, you can choose versions with integrated magnetic clamps.



1 Inductive safety sensors
2 Emergency stop device
3 Safe IO-Link I/O modules
4 Transponder-coded safety sensors
5 Electromechanical safety switches
6 Opto-electronic protective devices

For pneumatics and hydraulics

Safety for Clamping Devices

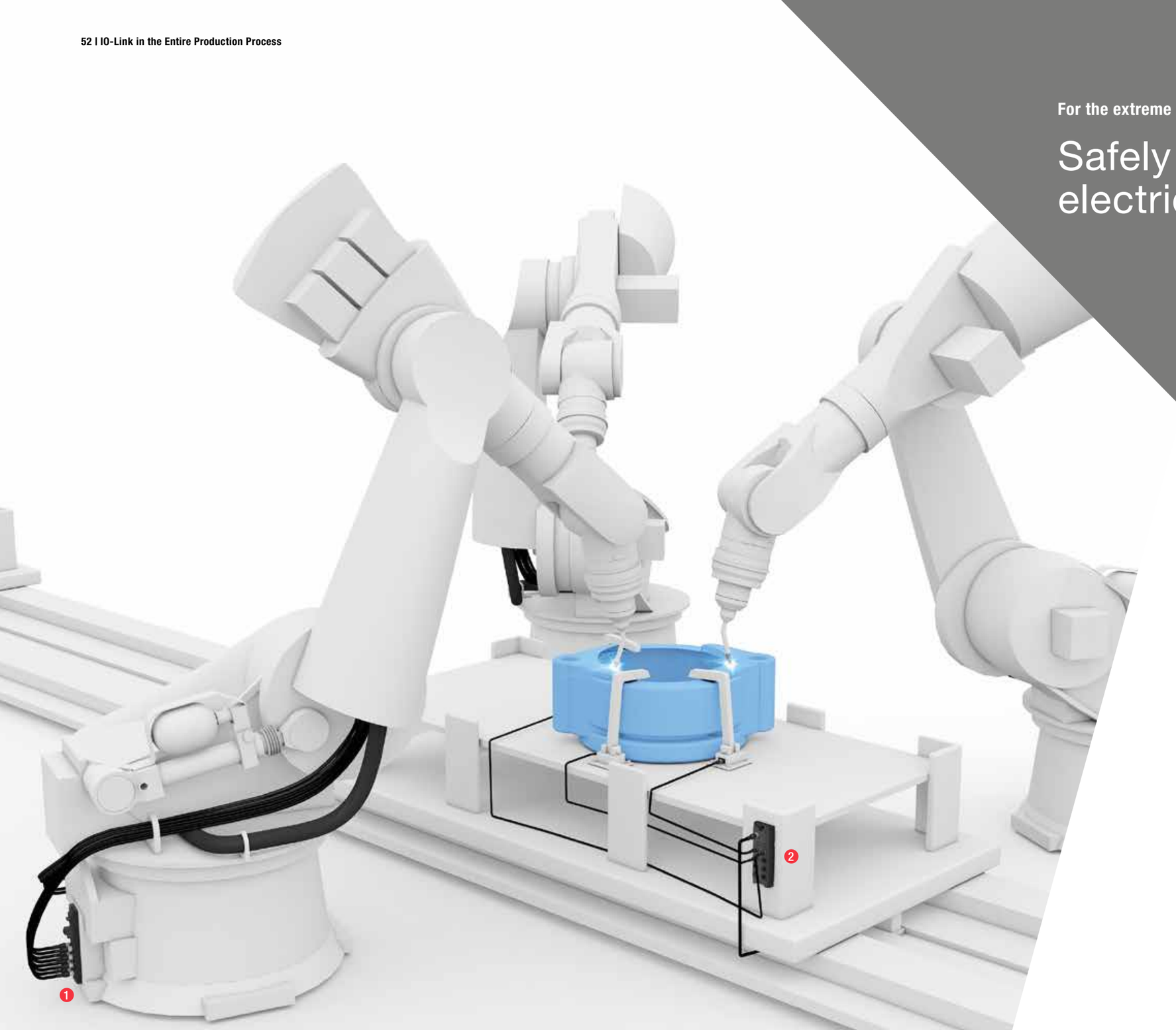
All-in-one solution for connecting sensors and actuators – galvanically isolated

Our galvanically isolated sensor/actuator hub ensures safety on the workpiece holder. This all-in-one solution allows you to connect both sensors and actuators to just one module. The sensor segment provides the position feedback. At the same time, you can safely turn off the actuator segment using its separately switchable safety circuit, since the IO-Link I/O hub is divided into two galvanically isolated segments.

To safely interrupt the supply voltage to the actuator segment you need an external safety device. Then you can implement safety functions up to SIL2 in accordance with EN62061. Also reassuring: the rugged IP67 metal housing is designed even for the harshest surroundings. Diagnostics is provided by IO-Link and status LEDs. You can also reliably monitor the signal quality.

Up to eight digital in- and outputs can be controlled with the module. If the IO-Link connection is interrupted, the outputs assume predefined states which remain until the IO-Link connection is restored. Because of this clear machine status, you can continue to produce without a reference move and save valuable time once the connection is made again.

1 **Magnetic Field sensors**
2 **IO-Link master**
3 **IO-Link I/O module with galvanic isolation**
4 **Emergency stop device**



For the extreme conditions of welding

Safely transmit signals in electrical interference fields

Decentralized system architecture in the welding booth

For the extreme conditions of welding, Balluff offers rugged modules for reliable signal transmission even in the presence of interfering ambient influences. Our weld-immune modules, made of fiberglass reinforced plastic, can reliably handle weld splatter, welding currents and electromagnetic fields.

The easy to install modules are available as IO-Link masters and IO-Link sensor/actuator hubs each with 8 IO-Link ports for 16 in- and outputs. Each input is short-circuit proof, each output is protected from overload. In addition, our IO-Link sensor/actuator hubs offer an expansion port for connecting an IO-Link valve interface or another IO-Link sensor/actuator hub, so that you can use up to 30 in- and outputs. This lets you flexibly integrate innovative fieldbus solutions.

The efficient point-to-point wiring of IO-Link allows construction of a decentralized system architecture in the welding booth outside the control cabinet. Network nodes equipped with an IO-Link master communicate via Ethernet/IP directly with the main controller or control device on the machine.

You can connect a wide variety of intelligent sensors or I/O modules with IO-Link interface to the IO-Link ports. Now you are using simple structures that are highly flexible. The parameters are also simple to transmit. Continuous diagnostics ensure reliable monitoring. And the affordable, three-core, unshielded industrial cables reduce wiring time.

1 IO-Link masters (weld-immune)
2 IO-Link sensor/actuator hubs (weld-immune)

Condition based maintenance and condition monitoring

The optimum voltage supply for noise-free operation

For noise-free operation

Our IO-Link Heartbeat power supplies, for reliable and efficient voltage supply, stand out with their quality and long service life. They are manufactured from the highest quality components and offer you adjustable output voltage with low ripple.

Especially notable is their clever diagnostics capability that supports predictive maintenance and condition monitoring for Industry 4.0 requirements.

Integrated monitoring provides information for Load Level, Stress Level and Lifetime via IO-Link. This gives you reliable information about the current electrical and thermal load, the degree of wear and the remaining lifetime of the power supply. You can also read off this information locally on the status indicator. The 3-color LEDs work here like a traffic light.

You use IO-Link to call up further detailed diagnostics and status information for the unit as well as operating parameters and history, so that you can see this data in the higher level control and diagnostics system. Now you increase system up-time by knowing at all times when you need to replace a unit.

Specially developed for controller units, Balluff power supplies can be perfectly integrated into your control package. The extra narrow IP20 housing makes possible a resource-optimized control cabinet design. IP67 variants for supplying power to the modules in decentralized structures in direct proximity to the consumer are also available.

1 Heartbeat power supplies with IO-Link IP20
2 Heartbeat power supplies with IO-Link IP67

We assist you expertly and personally

SERVICES

innovating automation

Meeting your specific needs

Our products are precisely tailored to your needs. Our services are too, for fast commissioning, optimum process flows and the greatest possible planning security and cost effectiveness. Would you like advice on products and services? Tailor-made solutions? Or expert know-how on site? You receive our comprehensive support. Expert, uncomplicated and totally according to your specifications.

Your Balluff solutions

- Technical support
- Training
- Support and consultation
- Development and integration
- Product-accompanying services
- Customer-specific solutions

REFERENCES

Our complete commitment is to the success of our customers. Future-looking technologies, market-oriented solutions and the expertise of an experienced manufacturer are what we draw on to increase your competitiveness. This is why leading companies worldwide trust in Balluff solutions.

We work together with such companies as

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brose Competence in Mechatronics
ec-tecs
EMA Induction Technology AICHELIN Group
EMAG
EWE DAS TEAM
EVOSYS LASERSOLUTIONS
+GF+
HELLER
IMA AUTOMATION MECTECH
KIT Karlsruher Institut für Technologie
LOESCH PACK PIEPENBROCK GROUP
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MAKA CNC Spezialmaschinen
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Headquarters
Balluff GmbH
Schurwaldstrasse 9
73765 Neuhausen a. d. F.
Germany
Phone +49 7158 173-0
Fax +49 7158 5010
balluff@balluff.de

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