



**BALLUFF**

 *innovating automation*

Plastics,  
Rubber and Tires

**PRECISION FOR HIGH  
SYSTEM AVAILABILITY**



# WE ARE AT HOME IN MANY INDUSTRIAL SECTORS













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Plastic

# RELIABLY MANAGING THE GROWING VARIETY.



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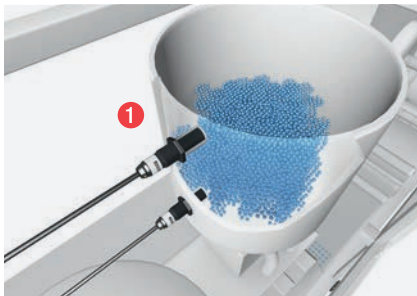
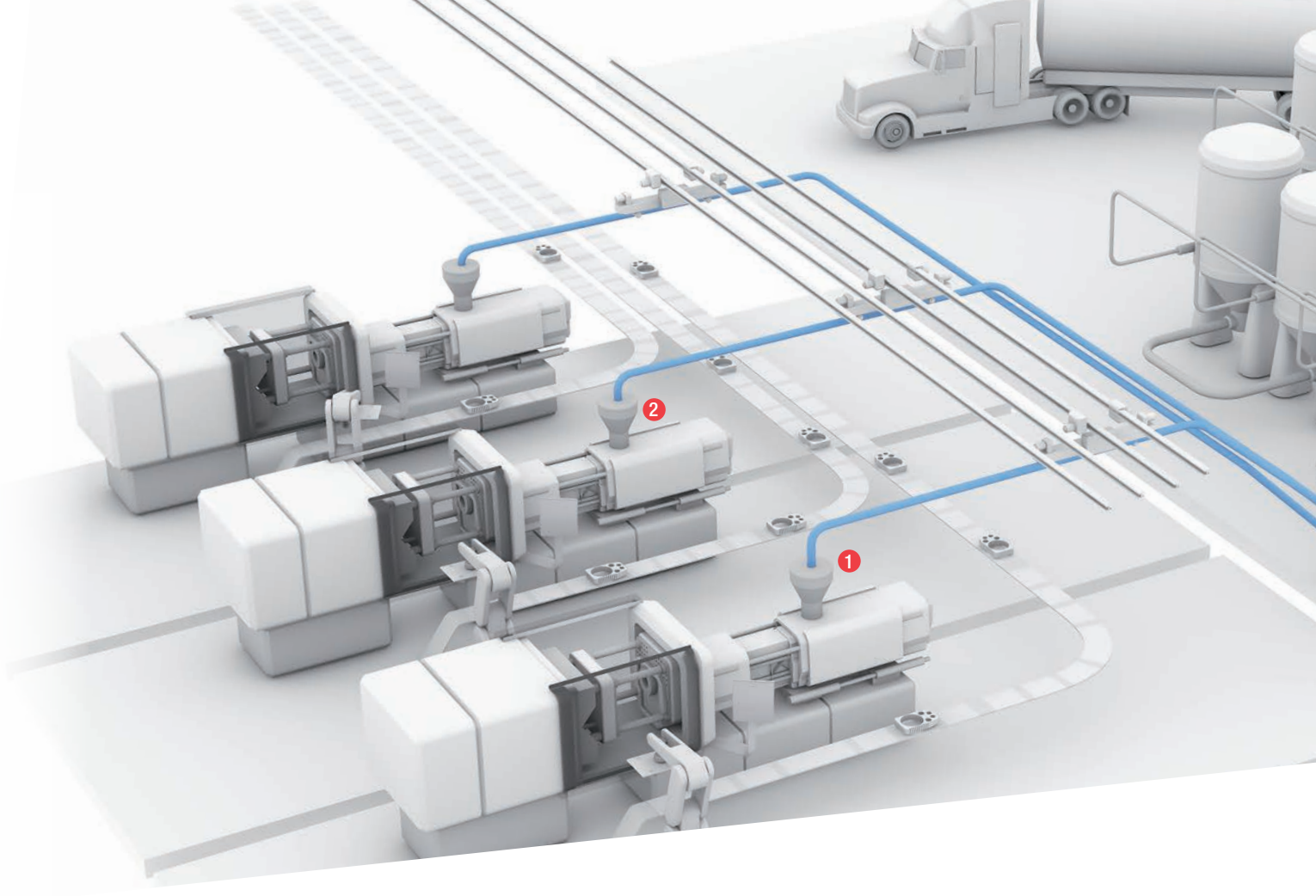
Plastic is the material of the 21st century. Its application range is enormous and is becoming ever broader thanks to new compositions, so the demands on production and machine building continue to grow.

Balluff offers high-performance sensor and system solutions with high-quality network and connectivity technology. And thereby the ideal prerequisites for reliably managing the growing variety. The high quality of our solutions enables sophisticated systems concepts, improves machine availability and contributes to more efficient utilization, whether in material handling, injection or blow molding, tire construction and heating presses, or bonding and joining technology. We also provide solutions for optimal tool utilization.









#### CONTINUOUSLY KEEP AN EYE ON THE FILL LEVEL

Our high-resolution ultrasonic sensors don't miss a thing: they reliably monitor the level of granulates and powders in silos. The continuous and contact-free measurement technology is virtually immune to dust and dirt. The fill level can be output as needed by an analog signal or with two switching signals as min/max values.

##### Features

- Contact-free
- Detects even the smallest objects
- Cubic and cylindrical designs

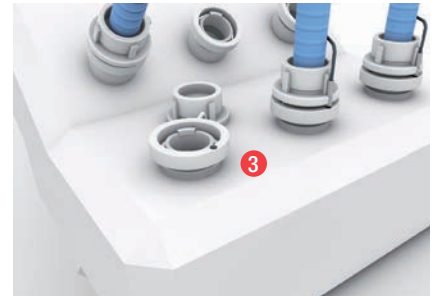


#### FILL LEVEL INDICATORS FOR CONTINUOUS MATERIAL FEED

To ensure constant material flow the min/max level must be detected continuously in the injection molding machine. Capacitive sensors can perform this task for you: whether in the hopper in direct contact with the materials or through the outer wall, the fill level indicators reliably determine all the values.

##### Features

- For all materials
- Simple sensor replacement
- Miniature designs



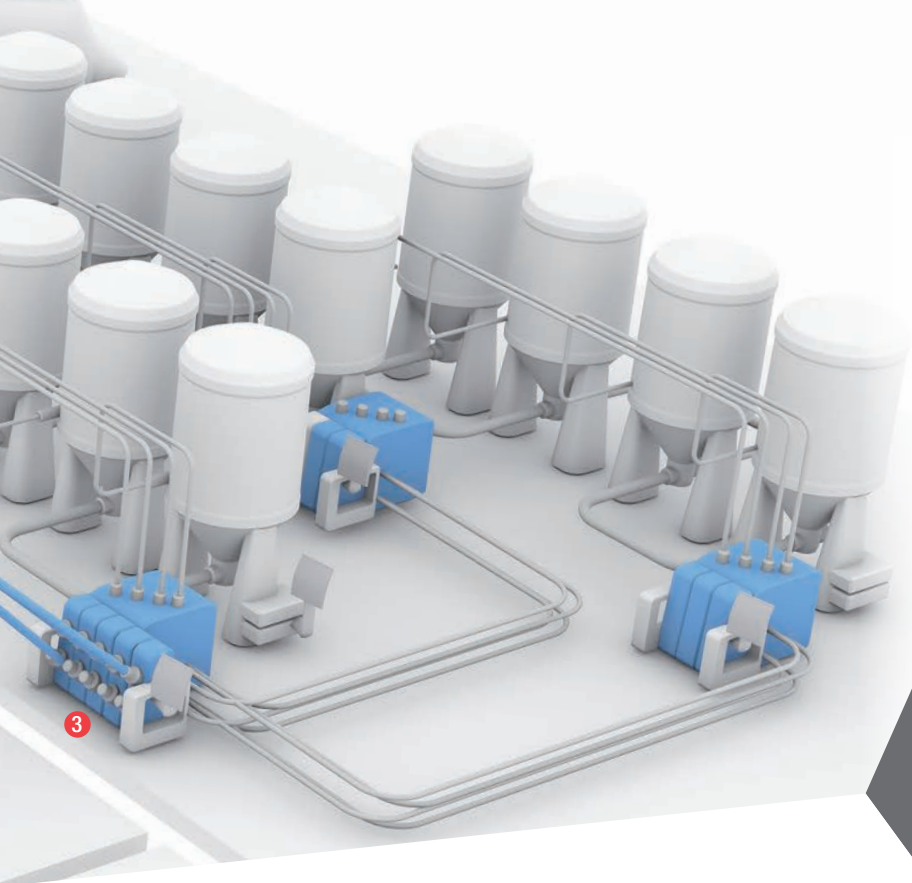
#### FAST AND RELIABLE CONTROL IN COUPLING STATIONS

To ensure the correct mixture of additives, dyes and granulates in the coupling station Balluff uses autonomous RFID systems. Each coupling is identified and only released if it is connected at the right location. This way, we ensure that the right component is always used.

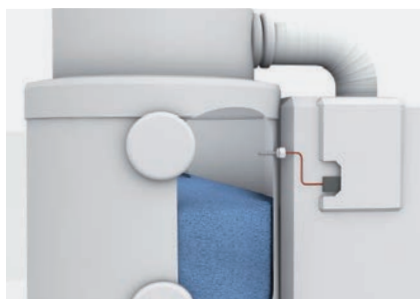
##### Features

- Rugged
- Quick and powerful
- Protection from improper filling





# Solutions for material handling



## HIGH-TEMPERATURE RATED SENSORS FOR DRYING

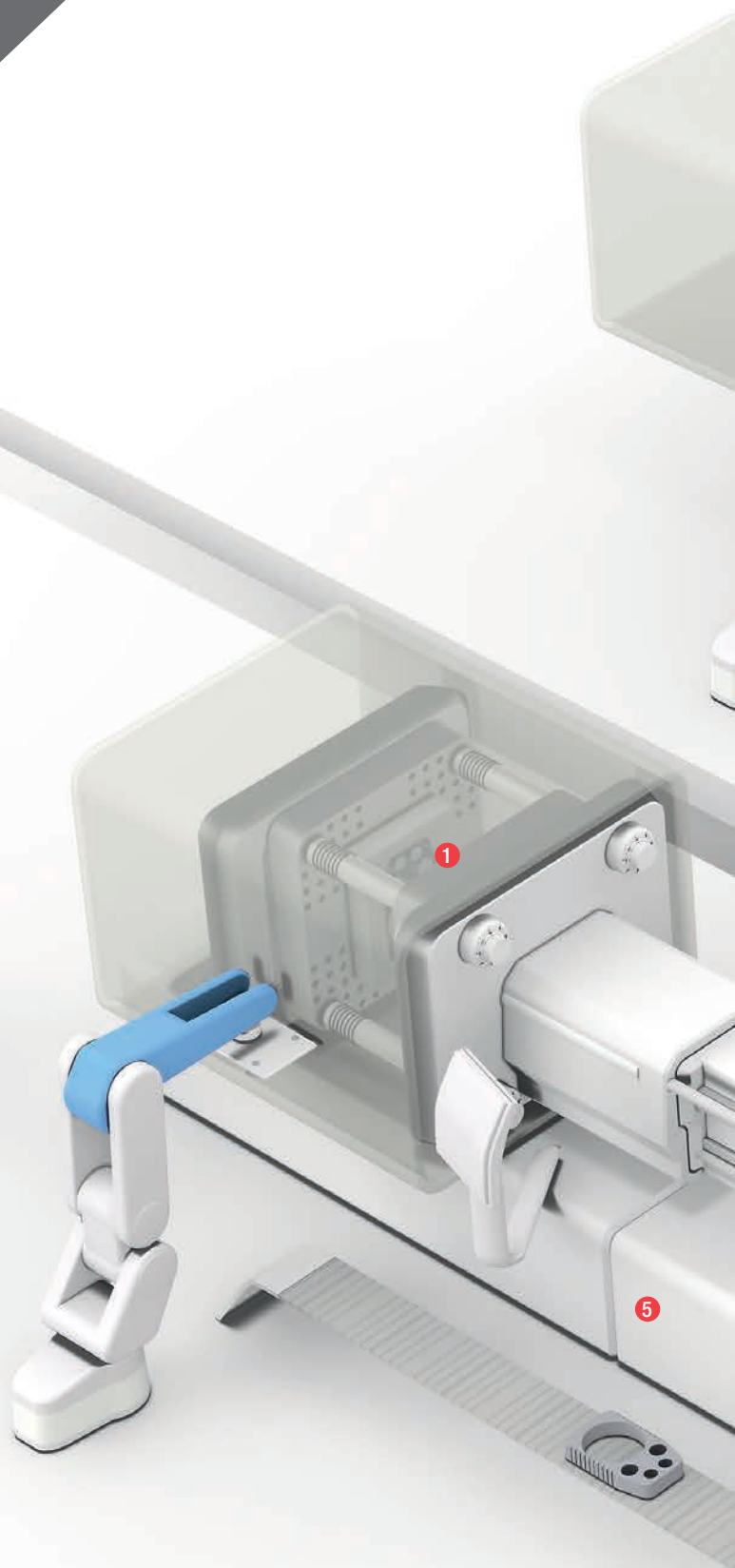
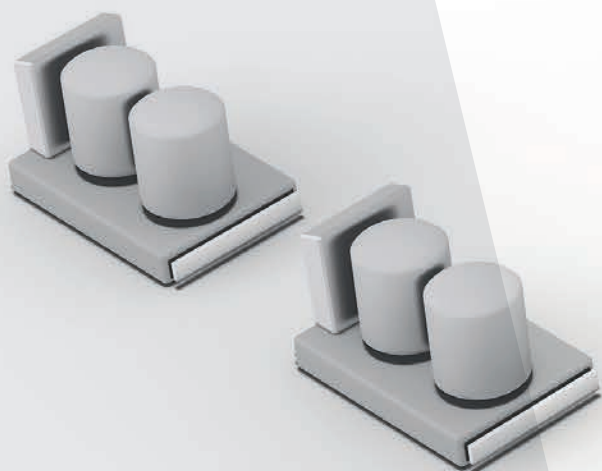
Dry granulate is essential for high-quality plastic parts. Our capacitive stainless steel sensors, resistant to high temperatures, ensure an even feed of the moist granulate into the dryer. They are heat resistant to 250 °C and reliably monitor all levels.

### Features

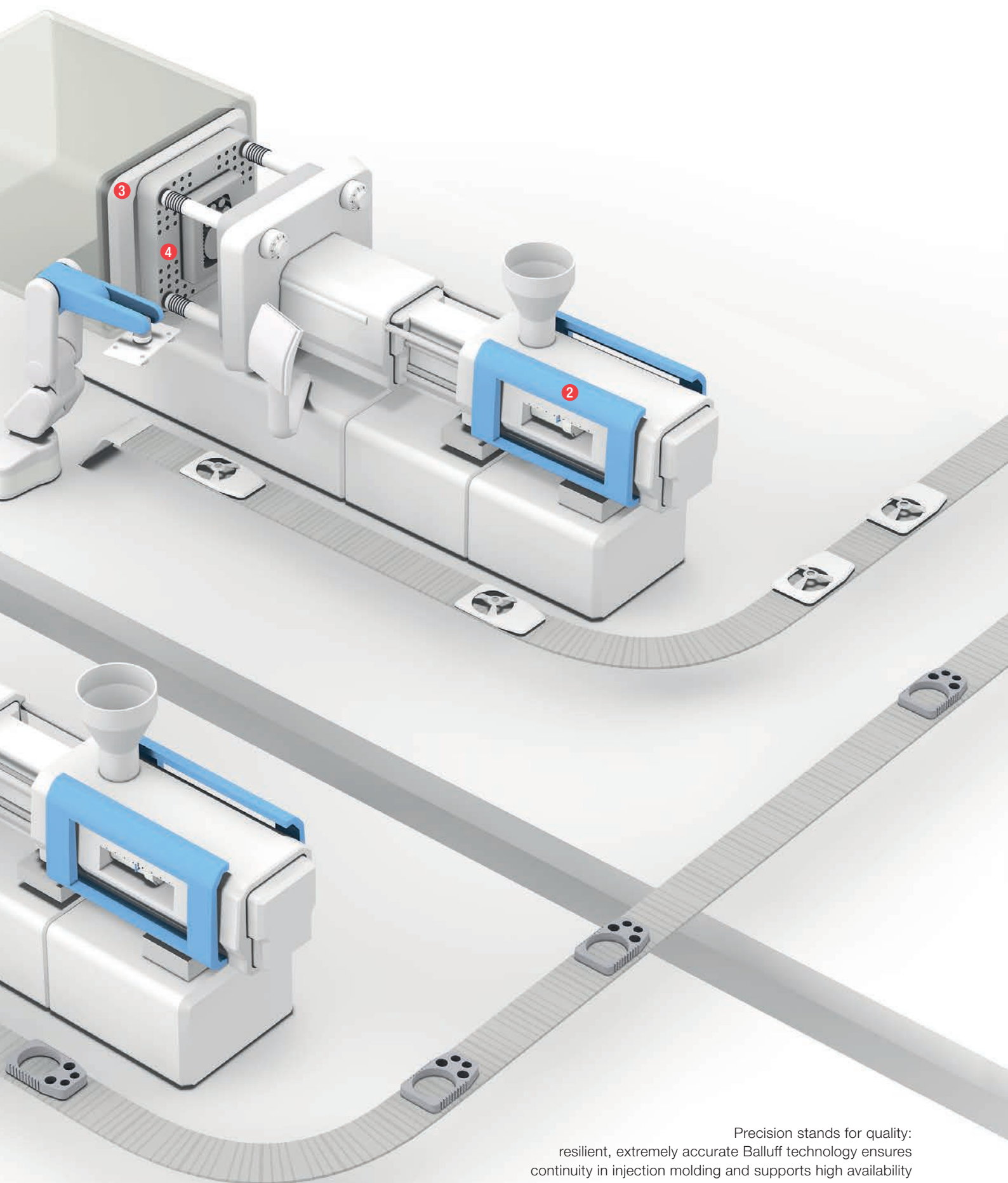
- Stainless steel
- Sensor head made of PTFE



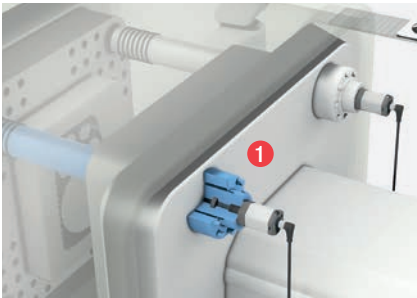
# Solutions for injection molding







Precision stands for quality:  
resilient, extremely accurate Balluff technology ensures  
continuity in injection molding and supports high availability  
of your equipment.

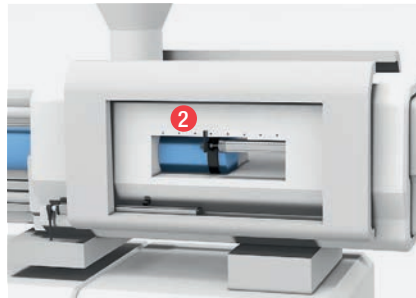


#### HIGH-PRECISION DISPLACEMENT TRANSDUCERS FOR A GENTLE MOLD CLOSURE

With the help of a high-precision magnetostrictive linear position sensor from Balluff you can precisely monitor the closing motion of the platen. A gentle mold closure reduces wear and extends your mold's useful life.

##### Features

- Contact-free and therefore wear-free
- No homing necessary, immediately ready
- Resistant to vibration, moisture and dust

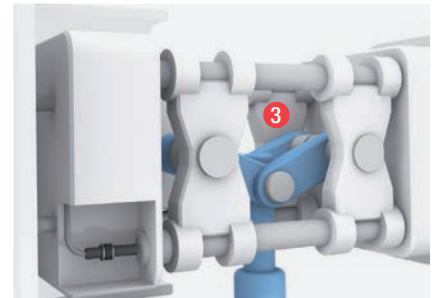


#### DETECTING THE INJECTION PROCESS

Our BIW inductive positioning system ensures that your molds are quickly filled because the high sampling frequency and repeat accuracy measure the travel of the injection axis precisely and reliably. You can exactly calibrate the injection profile, for example, to produce high-quality, thin-wall parts.

##### Features

- Fast: High measuring frequency of 32 kHz
- Non-contact position detection
- High repeat accuracy



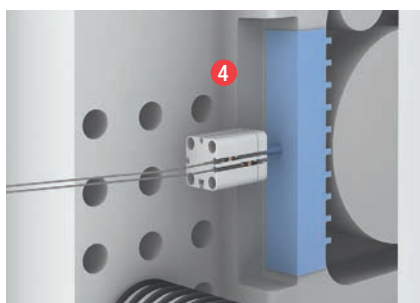
#### CONTINUOUS MONITORING WITH INDUCTIVE SENSORS

Inductive distance sensors from Balluff ensure continuous monitoring of the tie bar extension in the process. They are insensitive to contamination and provide optimal linearity as well as high repeat accuracy.

##### Features

- Distance-proportional, analog output signal
- Measuring ranges from 0.5 to 50 mm
- Measuring speed up to 40 m/s





#### DETECT THE POSITION OF CORE PULLS

To optimally adjust core pulls our magnetic field sensors in the mini-format are ideal. They ensure that the core pull is at the required end position and they detect the position directly at the hydraulic block cylinder. Alternately, you can use high-temperature rated sensors.

##### Features

- Designed for tight mounting locations
- Can be fully integrated
- Low weight
- Wear-free position detection
- Two teachable switching outputs via IO-Link for up to eight switchpoints

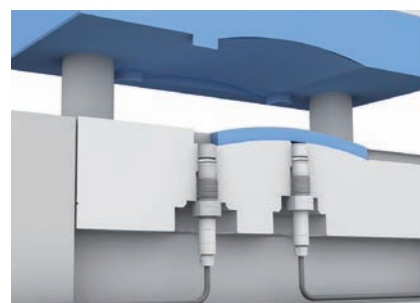


#### CONTINUOUS PRESSURE MONITORING WITH IO-LINK

Perfect closure of the clamping plates requires the correct pressure. Reliable pressure monitoring in the hydraulic cylinder is handled by a rugged pressure sensor in a stainless steel housing. Equipped with IO-Link, the pressure sensors relay their values directly to the controller and thus let it readjust with precision.

##### Features

- Extended temperature range up to 125 °C
- Up to 600 bar
- Process-oriented installation



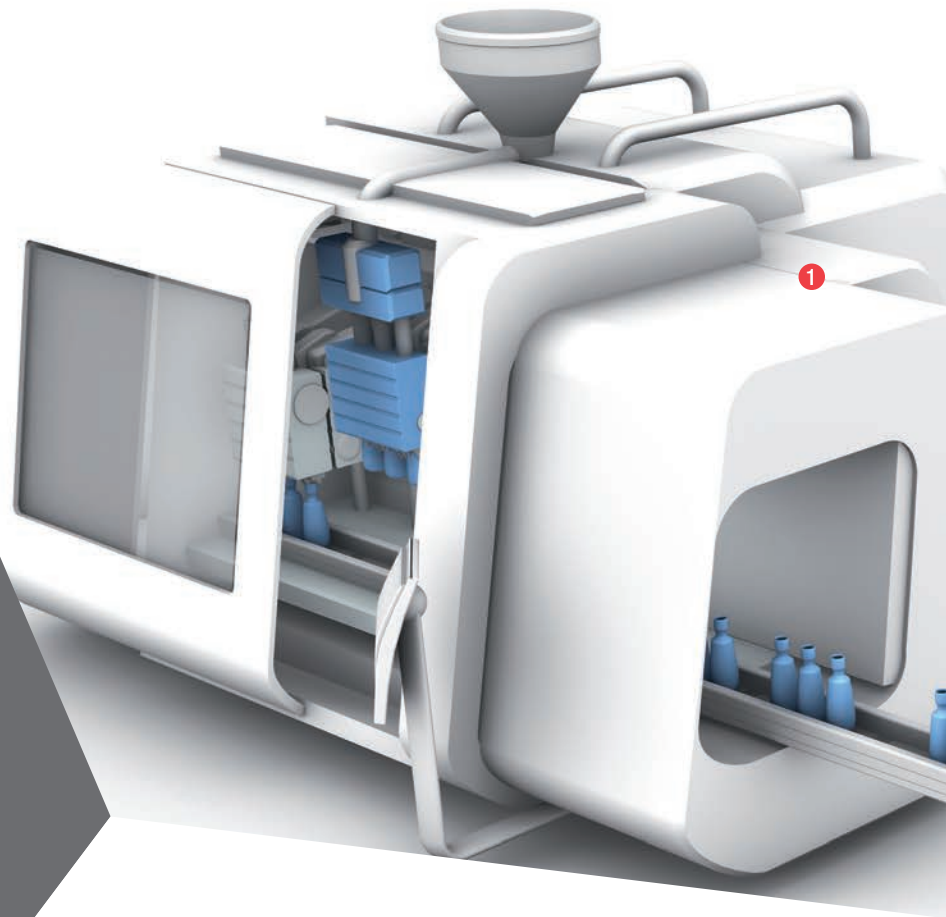
#### MEASURING MOLD FILLING IN RTM (RESIN TRANSFER MOLDING)

Our high-pressure and high temperature rated capacitive sensors reliably check whether the cavity is fully filled and the RTM is completed. They offer great mechanical stability, e.g., for lightweight construction and can be integrated directly in the tool. Their specially polished surface prevents plastics and composites from sticking.

##### Features

- Pressure rated to 150 bar
- Temperature-resistant up to 180 °C
- Flush-mounted

# Solutions for blow molding



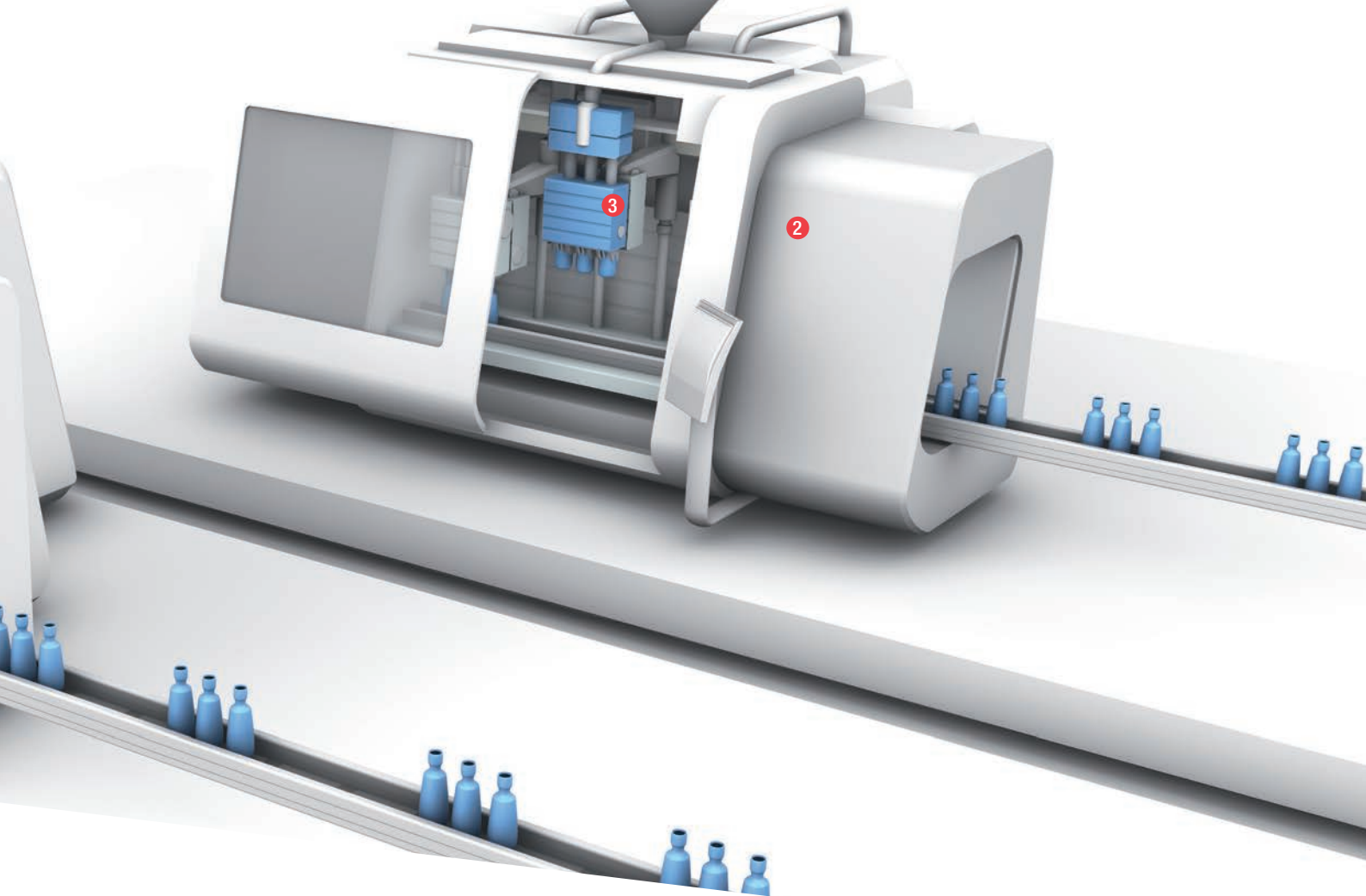
## A MODULE FOR MORE TRANSPARENCY

The Balluff EtherCAT module with IO-Link interface collects all the signals from the various standard sensors and relays them to the controller. This solution simplifies the entire network structure and creates transparency down to the last meter.

### Features

- 8 independent IO-Link ports
- Integrated display
- Automatic address assignment



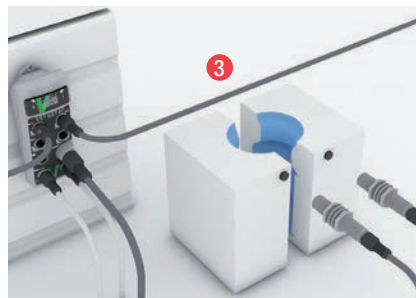


#### ALL MOVEMENTS FIRMLY UNDER CONTROL

Travel movements at the blow station are under control with Balluff BTL magnetostrictive linear position sensors even if there are vibrations. The high-precision measurement systems have an EtherCAT interface. Because of their contact-free and wear-free measuring principle, they contribute to long machine running times.

##### Features

- EtherCAT interface
- No homing necessary, immediately ready



#### FAST MOLD CHANGING AND RELIABLE PROTECTION AGAINST COUNTERFEITS

Balluff Industrial RFID enables fast and reliable mold replacement with the unambiguous association of mold halves through unique IDs. You also benefit from secure counterfeit protection. This solution allows for rapid size changes and facilitates a continuous process.

##### Features

- Flexible, non-contact data communication
- Fast and sturdy
- Counterfeit protection



#### FILL BEVERAGES ON SITE

The beverage industry uses stretch blow molding machines to produce bottles. If the bottles are filled immediately afterward, our high-precision SF fill level sensor controls the fill level during the process. On-site filling can save you transport distances and thereby minimize costs.

##### Features

- Ecolab, 3A-approval, IP69K
- For aseptic processes
- Safe for sterilization (SIP) and cleaning (CIP)

# Solutions for bonding and joining technology



## FAST AND PRECISE ALIGNMENT OF THE WELDING HEAD

Our fast and high-precision magnetic encoders give you precise position feedback. They position the welding head exactly at the right place. Because the absolute measurement is made directly on the load, tolerance shifts and inaccuracies are prevented.

### Features

- Accurate position feedback
- Compact housing
- Ideal for short strokes



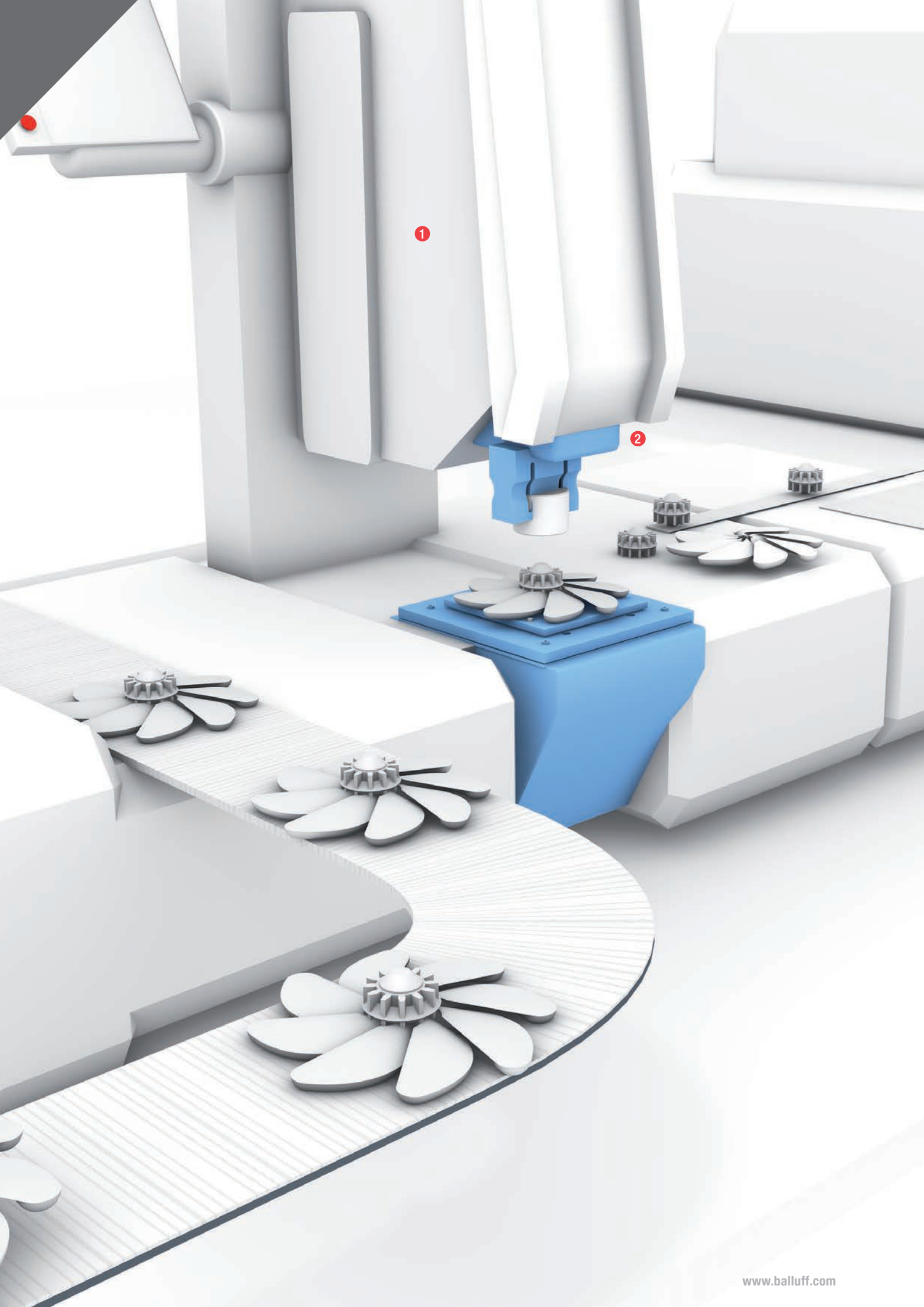
## VISUAL QUALITY CONTROL

The SmartCamera checks all the parts including their production stages: Are they complete and defect-free? Are the size, distance and position correct? And are they correctly aligned? The best part: all the steps can be easily taught.

### Features

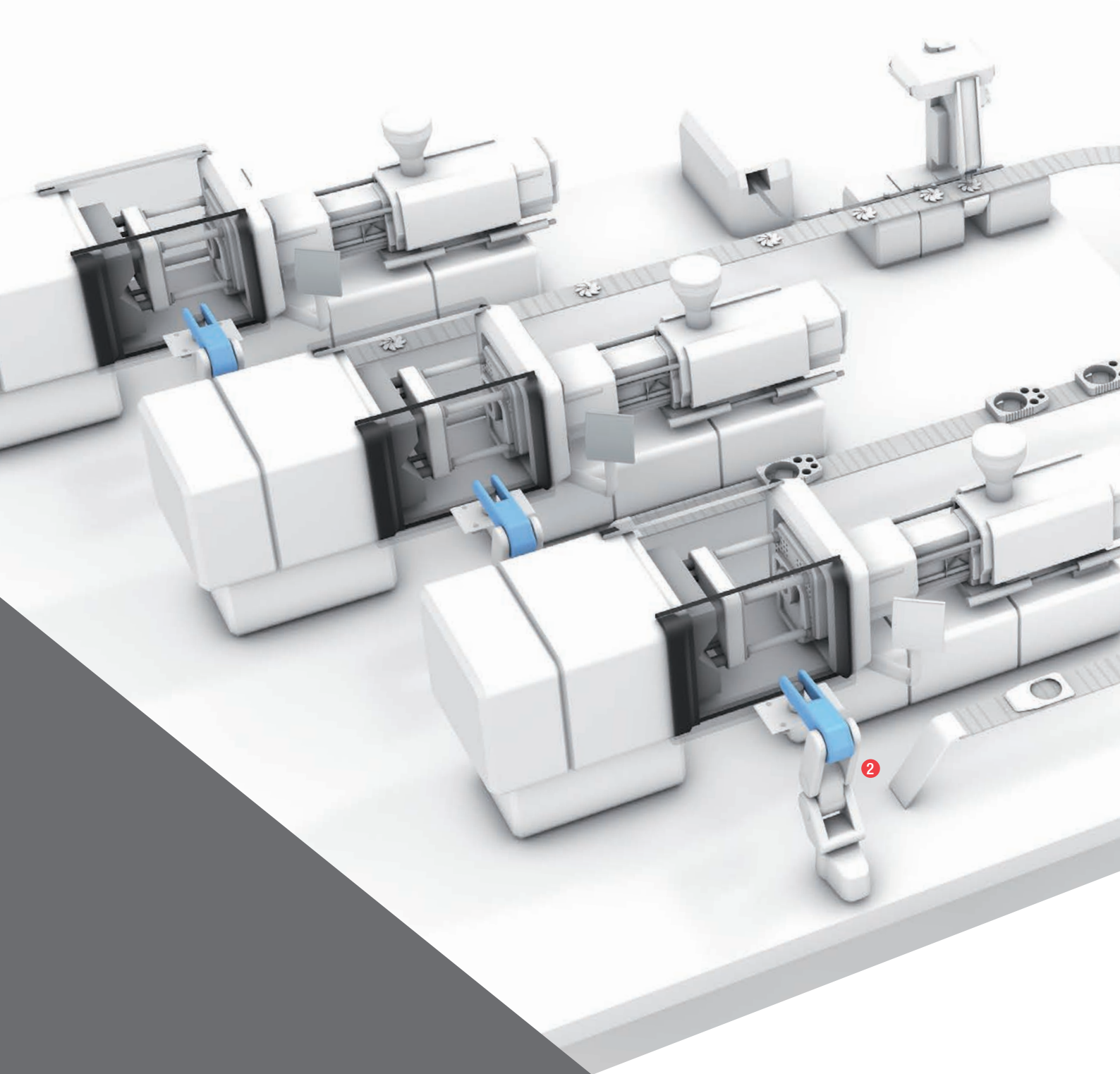
- Flexible use of analysis tools
- Simple to operate with user-guided teach-in
- Optimized display of the results





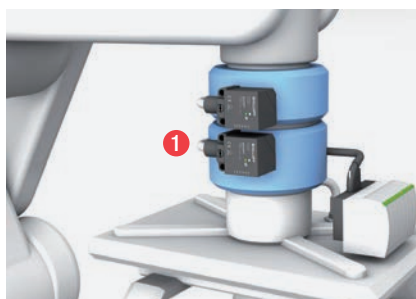
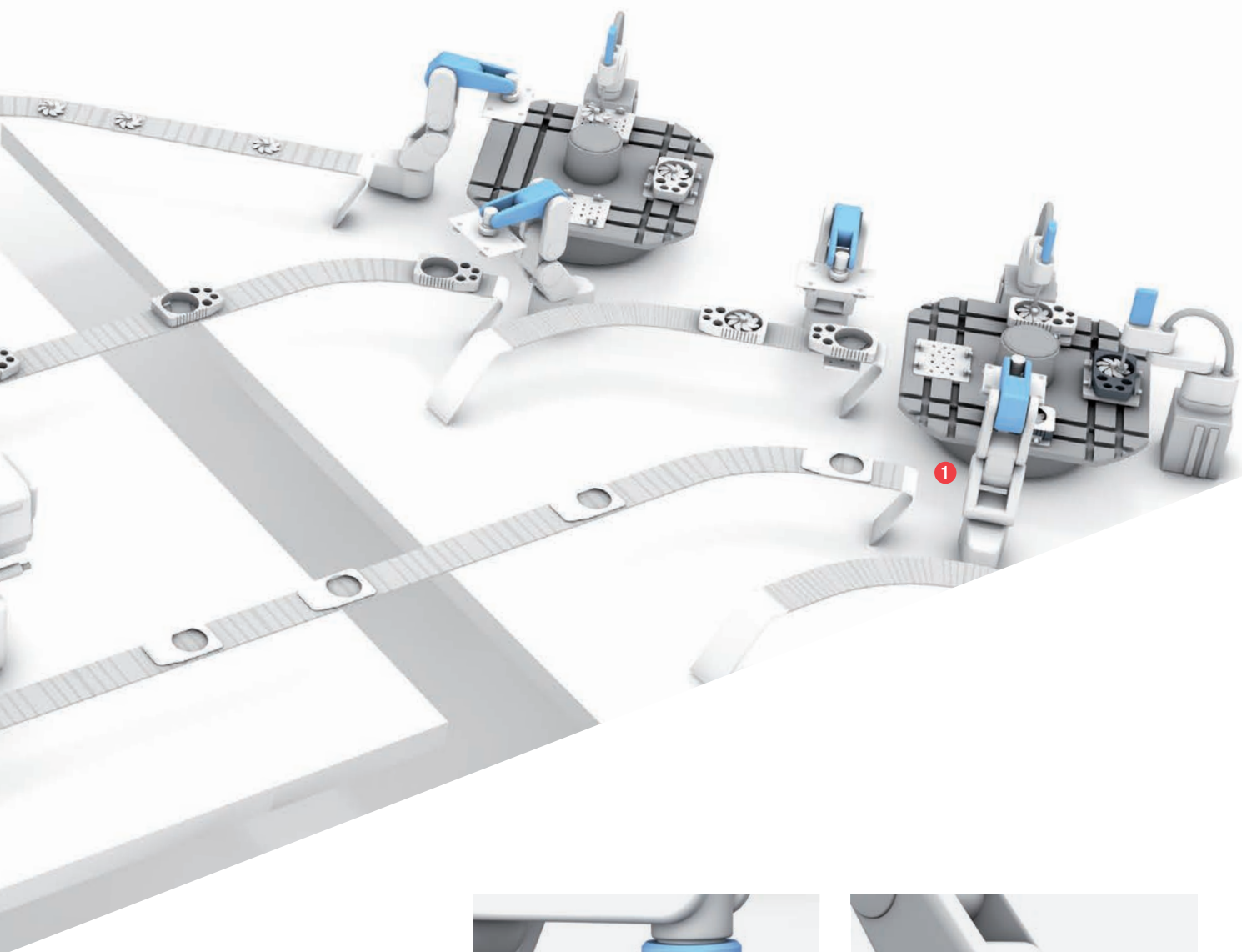
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2



Solutions for  
robotics and  
automation





#### SIMPLE GRIPPER CHANGES USING INDUCTIVE COUPLERS

With the help of Balluff inductive couplers, the need for manual insertion of mechanical connectors is eliminated. The couplers send signals and power without contact, are easy to use and offer maximum flexibility. The quick-disconnect units can be changed in the gripper in just moments.

##### Features

- Long service life, no mechanical wear
- Plug-and-play
- Weight savings




#### COST REDUCTION THANKS TO SIMPLE RECORDING OF SIGNALS

Our IO-Link sensor hubs made of plastic or metal collect the signals from the sensors embedded in the gripper and pass them along in bundled form to the controller. The controller can be connected to a 16-port IO-Link master, which records the signals of up to 272 sensors. This reduces your wiring effort, saves weight and reduces cost.

##### Features

- Easy to install
- Central parameter setting
- Continuous diagnostics





Rubber and tires

# PRECISION AND QUALITY FOR HARSH CONDITIONS



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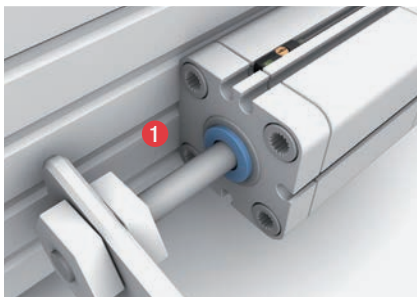
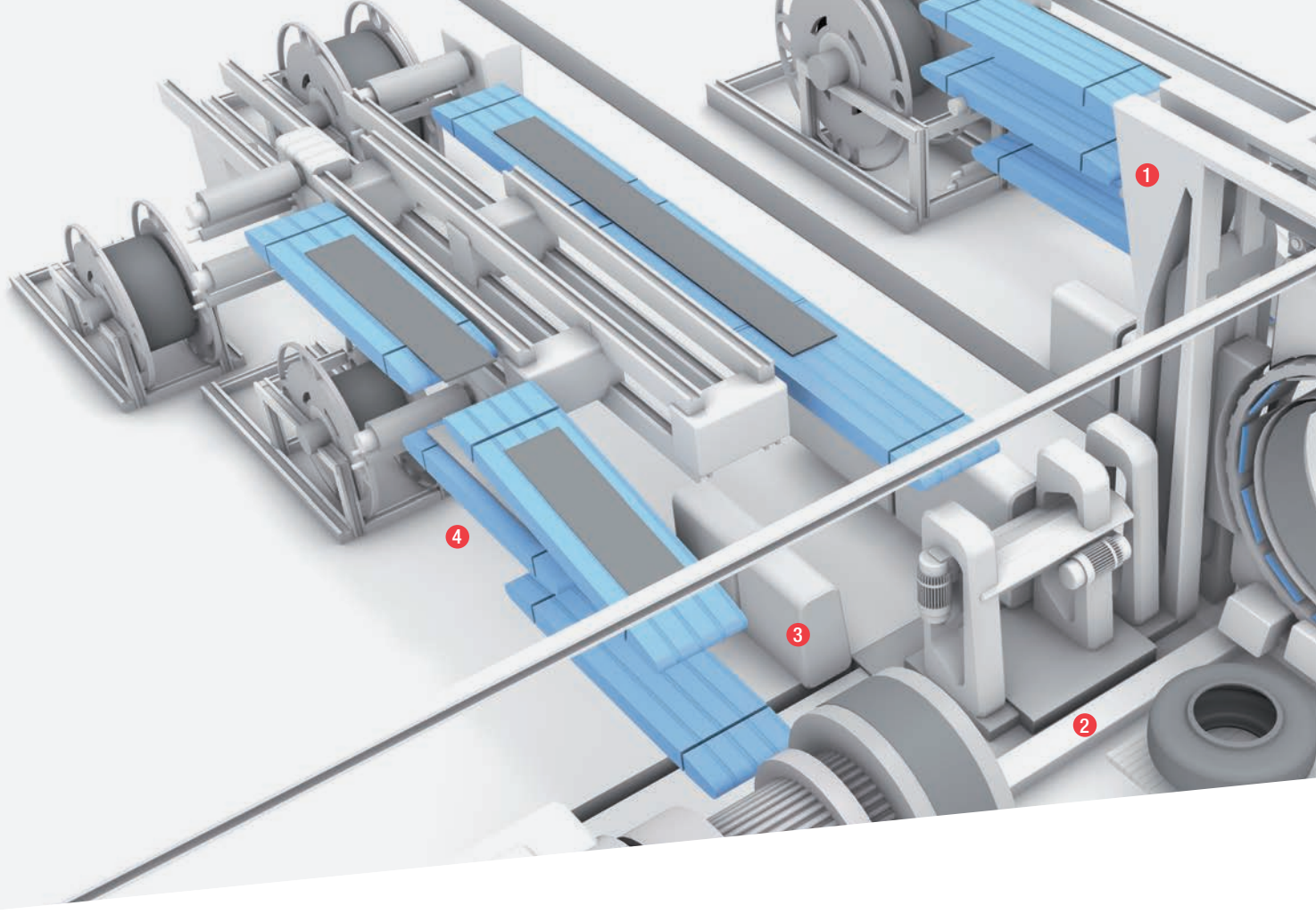
To address production of different batch sizes with minimal changeover times Balluff offers advanced and rugged technology for the tire building machine and heat press. Our high-quality sensors detect end positions of the pneumatic cylinders, position the sliders for the correct tire build, monitor for liner sag, and ensure the same pressure for each press cycle. They remain unaffected by heat, steam and aggressive media.

Use our machine concepts and profit from high equipment availability to further increase the productivity of your manufacturing process.







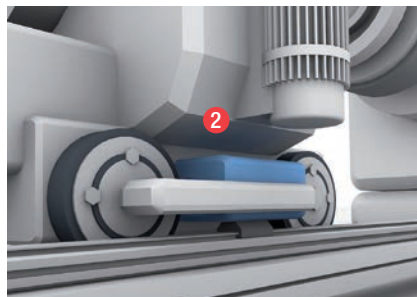


#### CONTROLLED MOVEMENT OF THE TIRE BUILDING MACHINE

Our magnetic field sensors reliably detect the end position of the piston in pneumatic cylinders and ensure proper motion of the tire building machine. The sensors, which are resistant to temperatures up to 105 °C, replace wear-prone magnetic reed switches and have a long service life.

##### Features

- Precise switching point
- Also for short stroke cylinders
- Wear-free

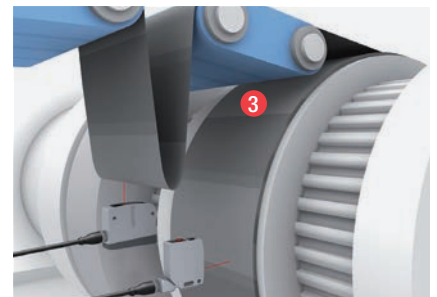


#### MAXIMUM PRECISION DURING WINDING

High fitting accuracy means each tire layer must be precisely fed, wound and cut. Our BTL magnetostriuctive linear position sensors position the slide with precision, even in rough conditions. This ensures that the tire build precisely complies with the specifications.

##### Features

- Highly precise and wear-free
- Impervious to vibration



#### CONTINUOUS MONITORING WITH PHOTOELECTRIC DISTANCE SENSORS

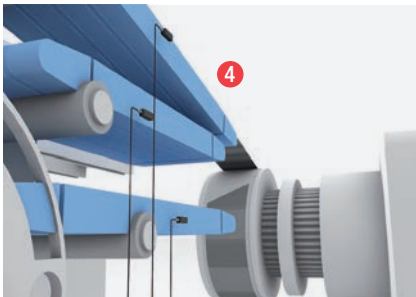
Our photoelectric distance sensors continuously check the roll diameter in order to continuously provide the winding roll with tread strips for the green tire. The robust sensors also perform sag control. The difficult-to-detect black layers have no effect on the result.

##### Features

- Absolute, distance-proportional analog signal
- Compact, solid and reliable
- Also available with IO-Link



# Solutions for tire building machines

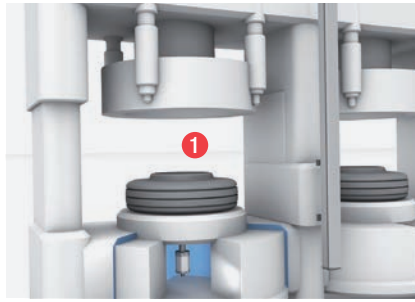


## PRECISE MONITORING OF TILT MOVEMENTS

Balluff inclination sensors reliably monitor the tilt movements of the conveyor belt. This allows the belt to be accurately guided when it is moved for the subsequent work steps. The inclination sensors guarantee a high accuracy of  $0.1^\circ$  and very low temperature drift.

### Features

- Precise position monitoring
- Extended temperature range  
-40 to 85 °C



#### RELIABLE CLOSING STROKE, EVEN UNDER EXTREME CONDITIONS

When the green tire is pressed into the hot mold under high pressure with hot water, the heating press must be tightly closed. A reliable closing stroke is ensured by Balluff BTL magnetostriuctive linear position sensors, even under high temperatures and strong vibrations.

##### Features

- Profile housing for easy installation
- Temperature rated



#### RELIABLE PRESSURE TRANSMITTER FOR HIGH TEMPERATURES

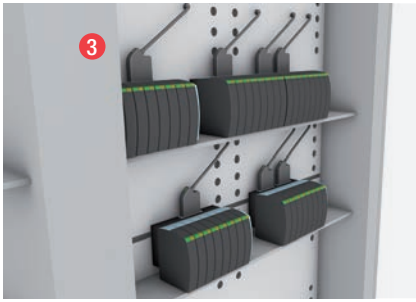
Balluff pressure transmitters ensure that the pressure in the heat press is reliably monitored. They are distinguished by a broad temperature range of  $-40$  to  $125\text{ }^{\circ}\text{C}$  and reliable measurement technology. The rugged transmitters are flexible to use: you can select from eleven different pressure ranges, voltage or current output, as well as various process connections.

##### Features

- Extended temperature range
- Stainless steel housing
- Great product variety

# Solutions for heat presses



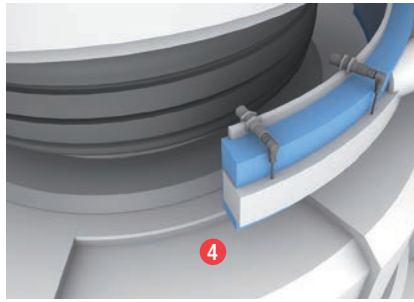


### REDUCE COSTS WITH IO-LINK

All the pneumatic lines come together in the control cabinet. With our IO-Link valve terminal connectors you use a simple industry standard cable to connect with the controller. This makes it easy to control the reliable movement of the pneumatic cylinders. This reduces cost: with IO-Link, you can reduce the wiring effort and require less cable and hose material.

#### Features

- Compact adapter housing
- Pin compatible with a wide range of valve terminals
- Controls up to 24 solenoids

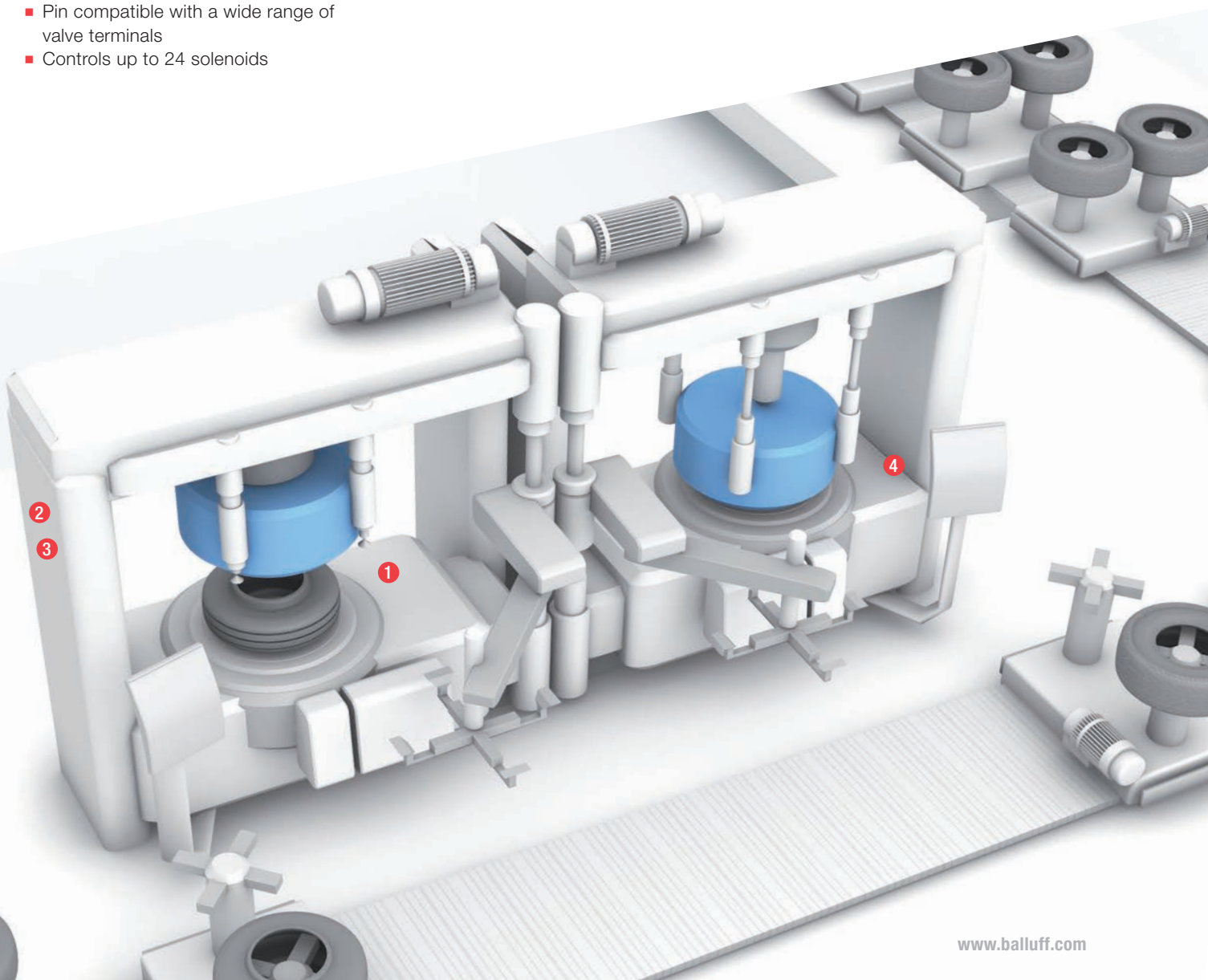


### OPTIMUM SUPPORT FOR ALL PROCESSES

Our high-quality and high-temperature resistant sensors support all processing steps of the heat press and reliably ensure an optimum process. Optical sensors reliably detect black rubber. Pressure sensors reliably monitor process media such as hydraulic fluids. Inductive sensors monitor end positions at little cost.

#### Features

- Resistant to lubricants
- Durable seals



## Systems

# Mold-ID – automatic data acquisition

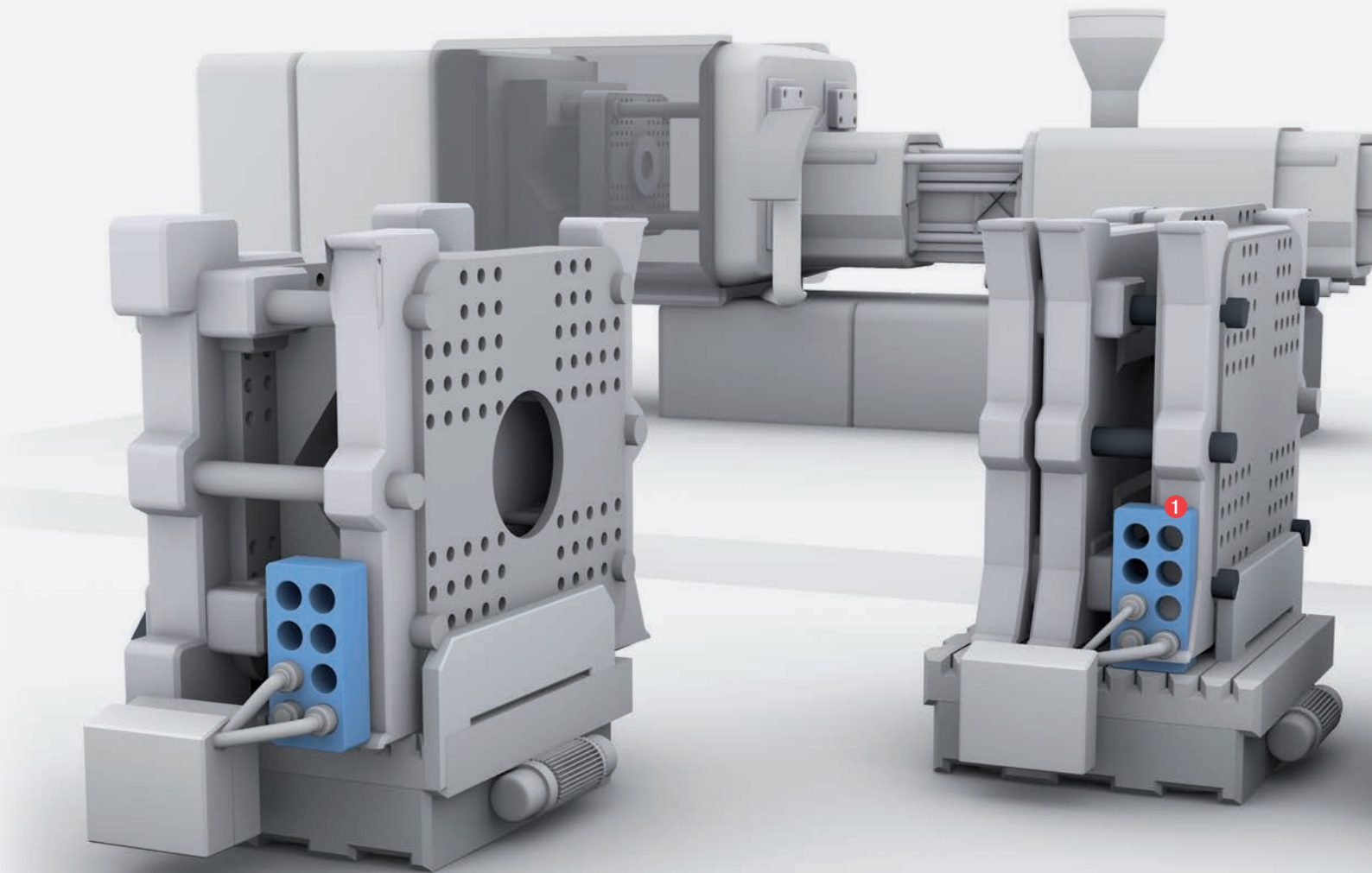


The autonomous Balluff Mold-ID system guarantees condition-based maintenance of the molds without time-consuming and error-prone mold logs because all relevant data, such as drawing number, number of shots, last maintenance or service life, is automatically saved on the mold and can be retrieved at any time. The optimum capacity utilization of the injection molds is thus guaranteed. You can retrofit all machines individually regardless of location or manufacturer.









# Solutions with Mold-ID



## OPTIMAL UTILIZATION OF MOLDS

With automatic documenting of the mold utilization via RFID you can reduce unplanned downtimes. A separate shot counter records all production cycles. All the data is available on a data carrier either directly on the mold or on the multi-coupling. In this way you can see the mold condition directly on the machine and always keep an eye on the life cycle of the current mold.

### Features

- Immediate information about the mold condition
- Mobile readout of the data using a smart phone or RFID handheld reader



# All the molds at a glance

## Why Mold-ID?

Mold-ID ensures condition-based maintenance of all your molds without having to maintain error-prone mold logs because all the relevant information is automatically recorded and documented. You are always informed, since the data can be recalled at any time. In this way you can accurately track the use of your injection molds and ensure their optimal utilization.

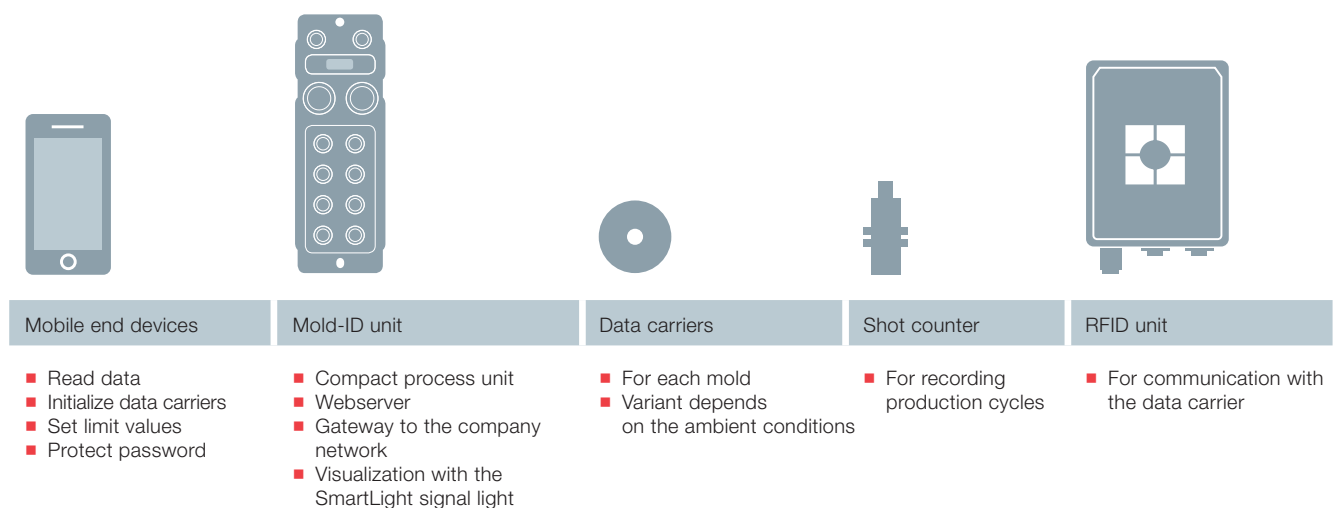
Transparent mold utilization with Mold-ID allows you to monitor maintenance and repair and provides you with basic information for optimizing your processes.

The best part: all machines can be upgraded individually, without the manufacturer and regardless of the location because Mold-ID is an autonomous system.

## What Mold-ID provides

- Fewer unplanned downtimes as the result of
  - continuous **counting** of the shots
  - automatic **documentation** on the mold
  - **visualizing** the mold status
  - notice for the operator about the next scheduled maintenance
- Transparency through the level of use of identically designed molds
- Overview of all molds currently running on the machines, through access to the systems over the company network via TCP/IP
- Mobile reading out of the documented mold data via smart phone or RFID handheld, for example, during an audit or when selecting the correct mold

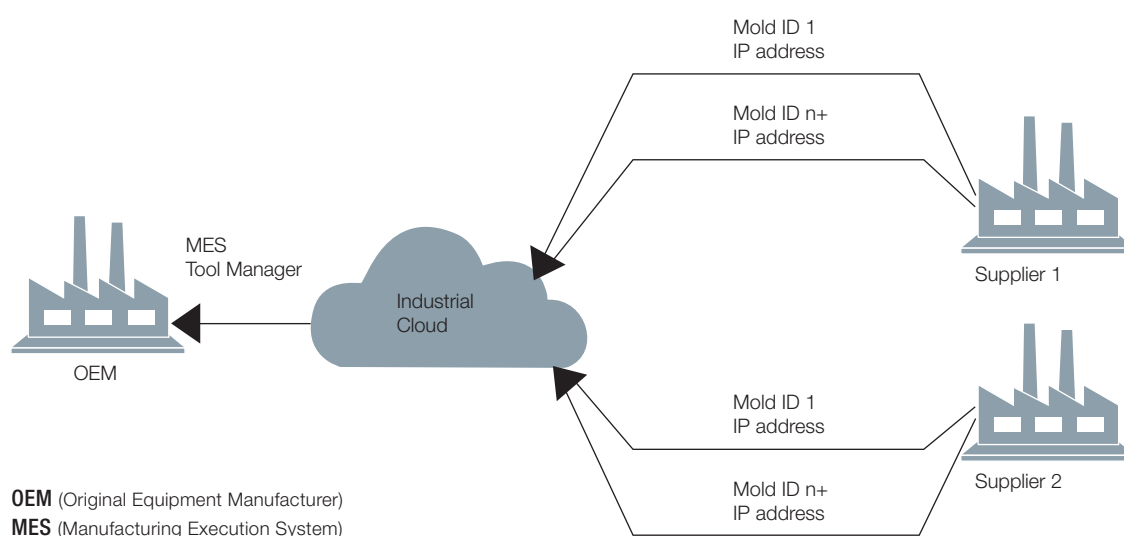
## Components of the Mold-ID system



## How you integrate tools and asset tracking across different plants

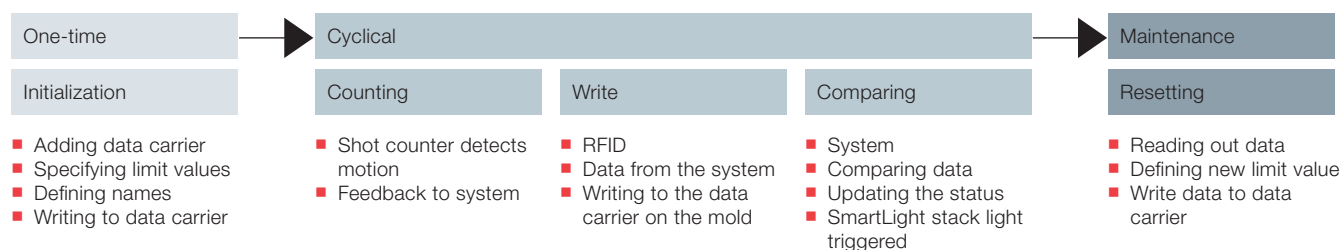
Many companies use their tools both at the main plant and in other production locations or at suppliers who are not connected to MES. In many cases you have only incomplete information about the location and condition of the tools, thereby preventing an overall view.

With Mold-ID you get detailed information about the entire stock of tools from plant to plant. And you achieve horizontal integration as defined by Industry 4.0.



## How Mold-ID works

The functions of Mold-ID can be divided into different phases. You can see examples of these phases here.





# INNOVATIVE SOLUTIONS FOR ALL REQUIREMENTS





CP -  
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BIS M



# Product overview.



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Application	Product group	Example	Functions, interfaces and properties
<b>MATERIAL HANDLING</b>			
Detecting levels in silos	BUS ultrasonic distance sensors	BUS000E	80x80 mm, analog output 0...10 V, operating range 600...6000 mm
Detecting limits (min/max) in hoppers	BCS capacitive sensors	BCS00NH	M30 × 1.5, preferred types (worldwide availability and applicability, good price/performance ratio), level detection, M12 connection
Identify couplings at the coupling station	Industrial RFID systems BIS	BIS00YL	Data carrier, Ø 7.9 mm, memory capacity 112 bytes
		BIS013Z	Read/write head, Ø 14.5 mm, for connecting to BIS-V processor units
		BIS00U9	BIS V processor unit, EtherCAT, connect up to four read/write heads, with IO-Link interface, other field-bus versions available
Detecting levels in granulate dryers	High-temperature rated capacitive sensors BCS	BCS00A1	M18 × 1, unshielded, high-temperature rated to +250 °C, please order sensor amplifier separately
	Sensor amplifier for BCS capacitive sensors without internal amplifier	BAE00L9	Standard version, narrow design, mountable on DIN rail, M12 connection
<b>INJECTION MOLDING</b>			
Measuring close movement	BTL magnetostrictive linear position sensors	BTL7-V50E-...*	Profile, with EtherCAT interface, measures up to 16 positions, stroke lengths up to 7620 mm
Detect movement of the injection axis	BIW inductive positioning systems	BIW1-A310-...*	Profile style, analog output 0...10 V, sampling rate typ. 32 kHz, stroke lengths up to 750 mm
Measuring clamping force on tie bars	BAW inductive distance sensors	BAW001P	M12 × 1, analog output 0...10 V, measuring range up to 2 mm, IP67
Monitor position of core pulls	BMF magnetic field sensors in mini-style	BMF00JJ	Up to 8 switchpoints configurable via IO-Link
	BHS high-pressure rated inductive sensors	BHS0058	M8 × 1, switching distance 1.5 mm, pressure rated to 500 bar, 2 m PUR cable

\* Please contact our Sales department to configure your product.

Application	Product group	Example	Functions, interfaces and properties
Monitoring pressures on hydraulic power units	BSP pressure sensors	BSP008Z	0...40 bar, analog output 0...10 V with one programmable switching point, IO-Link interface
Detecting plastic in the mold	BCS high-temperature and high-pressure rated capacitive sensors	BCS00TC	M12 × 1, length 38.5 mm, high-temperature rated to +250 °C, high-pressure rated to 150 bar, please order sensor amplifier separately
	Sensor amplifier for capacitive sensors BCS without internal amplifier	BAE00KH	Standard version, narrow design, mountable on DIN rail, 2 m PUR cable

## BLOW MOLDING

Collecting signals from standard sensors	IO-Link modules BNI	BNI0077	EtherCAT IO-Link master, 8× IO-Link 1.1, 16× I/O, IP67, additional fieldbus types available
Measuring closing and travel movements	BTL magnetostrictive linear position sensors	BTL7-V50E-...*	Profile, with EtherCAT interface, measures up to 16 positions, stroke lengths up to 7620 mm
Counterfeit protection, monitoring mold halves	Industrial RFID systems BIS	BIS004A	Data carrier, Ø 10 mm, memory capacity 2000 bytes
		BIS013H	Read/write head, M12 × 1, for connecting to BIS-V processor units
		BIS00U9	BIS V processor unit, EtherCAT, connect up to four read/write heads, with IO-Link interface, other fieldbus versions available
Monitoring level	BTL magnetostrictive linear position sensors, SF level sensor	BTL5-E17-...-SF-...*	FDA- and Ecolab-certified, IP69K, analog output IP69K, analog output 4...20 mA, temperatures up to 130 °C (1 hr)

## BONDING AND JOINING TECHNOLOGY

Precise welding head positioning	BML magnetic encoders	BML-S2B0-...*	Incremental measuring principle, resolution to 50 µm, output RS422, absolute versions available
Visual quality control	SmartCamera Color	BVS002F	Image resolution 1280 × 1024 pixels, IP67 (with protective tube), storage capacity 4 GB, process interface Profinet, Ethernet/IP, TCP, UDP, digital interface 8× input/output

Application	Product group	Example	Functions, interfaces and properties
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## ROBOTICS AND AUTOMATION

Simple tool changing	BIC inductive couplers	BIC0070, BIC0071	40 x 40 mm, bi-directional version, working range 1...5 mm, with IO-Link interface
Collecting sensor signals	IO-Link modules BNI	BNI0077	EtherCat IO-Link master, 8x IO-Link 1.1, 16x I/O, IP67, other fieldbus versions available

## TIRE BUILDING MACHINES

Detecting end positions on pneumatic cylinders	BMF magnetic field sensors for cylinders, standard version	BMF006U	PNP normally open, for T-slots, compact design, with LED, 2 m PUR cable
	BMF magnetic field sensors for cylinders, reed version	BMF008P	Normally open AC/DC, reed switch with LED, for T-slots, compact design, 3 m PVC cable
Controlling centric winding	BTL magnetostrictive linear position sensors, flat profile series	BTL6-U110-...*	Flat profile, with IO-Link interface 1.1, programmable measuring length, strokes up to 4572 mm
Monitoring roll diameter	BOD photoelectric distance sensors	BOD001E	Laser red light, PNP/NPN, normally open/normally closed, range 150...2000 mm, measuring range 1850 mm adjustable, analog output 1...10 V
Checking tilt movements on material feed equipment	BSI inclination sensors	BSI0002	Measuring range $\pm 45^\circ$ , resolution $\pm 0.01^\circ$ , analog output 4...20 mA, metal housing, M8 connector

## HEAT PRESSES

Monitoring the closing movement of the press	BTL magnetostrictive linear position sensors	BTL7-E500-...*	Rod style, analog output 4...20 mA, programmable measuring range, strokes up to 7620 mm
		BTL7-E501-...*	Profile style, analog output 4...20 mA, measuring range programmable, stroke lengths up to 7620 mm
Monitoring pressure in the heating press	BSP pressure transmitter	BSP...-DV004-...*	Pressure ranges selectable from -1 to 600, analog output 0...10 V DC, process connection G $\frac{1}{4}$ "
Sending bundled signals from valve terminals	Valve terminal plug BNI	BNI001K	Actuators, valve terminal and pneumatics can be turned off individually, 24 outputs, compact size, LED indicator

\* Please contact our Sales department to configure your product.




Application	Product group	Example	Functions, interfaces and properties
Heat press processing steps	BES inductive sensors	BES01C8	M12 × 1, PNP normally open, with LED, switching distance 2 mm, IP68, M12 connector
		BES04CK	M12 × 1, PNP normally open, switching distance 2 mm, temperature range –25...+160 °C, IP69K, 2 m FEP cable
	BOS photoelectric sensors	BOS013H	Series BOS 18M, PNP N.O./N.C., with LED, detection range 0...350 mm, M12 connector
		BOS01CL	Series BOS 50K, retro-reflective, red light, detection range 0.1...18 m, connection M12 connector
	BCS capacitive sensors	BCS001F	Disc Ø 22 × 4 mm, shielded, perfect for detecting rubber, please order sensor amplifier separately
	Sensor amplifier for capacitive sensors BCS without internal amplifier	BAE00L9	Standard version, narrow design, mountable on DIN rail, M12 connection
	BMF magnetic field sensors for cylinders	BMF00C9	For T-slots, V-Twin (two sensor heads), IP67, 0.3 m cable with M12 connector
	BLA light arrays	BLA0001	Light-band width 50 mm, max. distance 2 m, laser, 2× analog output 0...10 V or 4...20 mA switchable

## MOLD ID

Optimal utilization of molds	Industrial RFID systems BIS	BIS0176 BIS0180	Data carrier, PPS plastic, IO-Link
		BIS0189 BIS018E	Read/write head with integrated processor unit, M18 × 1.5, IP67, working temperature up to +70 °C
	Mold-ID unit	BNI00CE	Compact process unit, webserver, gateway to company network, visualization with SmartLight stack light, rugged housing, IP67
	Handhelds	BIS M-87_...*	Mobile reading and writing of BIS data carriers, with display and touch screen, WLAN optional



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We follow our motto „Innovating Automation“ as pacemakers 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. With innovative Balluff solutions you are well equipped for a successful future.

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# REFERENCES

The demands in the plastics, rubber and tire are high and getting higher. Our 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 companies worldwide trust in Balluff solutions for plastics, rubber and tire solutions.

We work together with such companies as



















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