# BALLUFF

# REVOLUTIONIZING OEE IN PACKAGING FOOD & BEVERAGE

**Applications for Efficiency**

*innovating automation*

**Food and Beverage Automation**

# ARE DOWNTIME AND PRODUCT QUALITY IMPACTING YOUR PRODUCTION EFFICIENCY?

*innovating automation*

While unplanned downtime can have many causes, such as material shortage, component failure, process jamming, or operator error, many of these problems can be minimized with the right plan. With proper management, even planned downtime, for required tasks such as product changeover, cleaning or scheduled maintenance, can be limited. By focusing on Overall Equipment Effectiveness (OEE), you can greatly reduce machine failures, set up times, idling, minor stops, reduced speeds, product defects, and waste, and gain more uptime.

This guide contains applications, case studies and technology considerations to help OEMs and manufacturers identify existing issues and offers Balluff-developed solutions to address them. This is done with a focus on six core application areas: controls architecture, format change, predictive maintenance, level sensing, robotic automation, and quality assurance. These applications have been tested in real world production and utilized by engineers, owners and managers at OEMs and manufacturers around the world to revolutionize OEE in the food and beverage industries.

- Dramatically shorten planned downtime and changeover time
- Add flexibility to production, allowing for shorter runs and more variety
- Reduce equipment build and installation time
- Increase efficiency, flexibility and visibility by utilizing IIoT and smart technologies
- Improve product quality with traceability and error-proofing solutions
- Eliminate unplanned downtime caused by failed automation components and processes

# CONTENTS

**Boost Productivity**

# REVOLUTIONIZING OEE IN FOOD AND BEVERAGE MANUFACTURING.

*innovating automation*

A review of our top partnerships in food and beverage manufacturing shows that availability, performance and quality are improved through collaborative efforts. Manufacturers and OEMs who embrace an application philosophy have found dramatic reductions in changeover time, eliminated product defects and shortened unplanned downtime. This application philosophy positively impacts OEE, brings automation technology and Industrial Internet of Things (IIoT) technologies into the plant, and generates value for the organization by improving production efficiency, enhancing product quality and adding flexibility for shorter production runs.

# YOUR PARTNER IN OVERALL EQUIPMENT EFFECTIVENESS

When striving to increase production with fewer losses, many food and beverage managers measure the efficiency and effectiveness of their processes utilizing the Overall Equipment Effectiveness (OEE) philosophy. To help our customers achieve valuable improvements to their OEE, Balluff has worked with manufacturers and OEMs to incorporate strong automation technologies that improve availability, expand performance and enhance production quality. We use our passion for automation and innovative technology to decrease loss-related factors and help you achieve your goals.

### Improve Availability

We want to work with you to increase machine output. This is done with a focus on improvements to planned downtime factors, like setup time and equipment changeover. In addition, unplanned downtime and machine failures can be dramatically reduced with monitoring and technology fit to the specific application. We can help you improve the availability of the equipment to produce more product.

### Enhance Quality

We want to work with you to reduce waste of all kinds in the plant. We can work toward eliminating production rejects and product defects by error-proofing processes. Shorten the waste created during startup and the high level of rejects during this window to improve the overall yields of the production run. Know where material is, where it came from and where it is going at every step of the process.
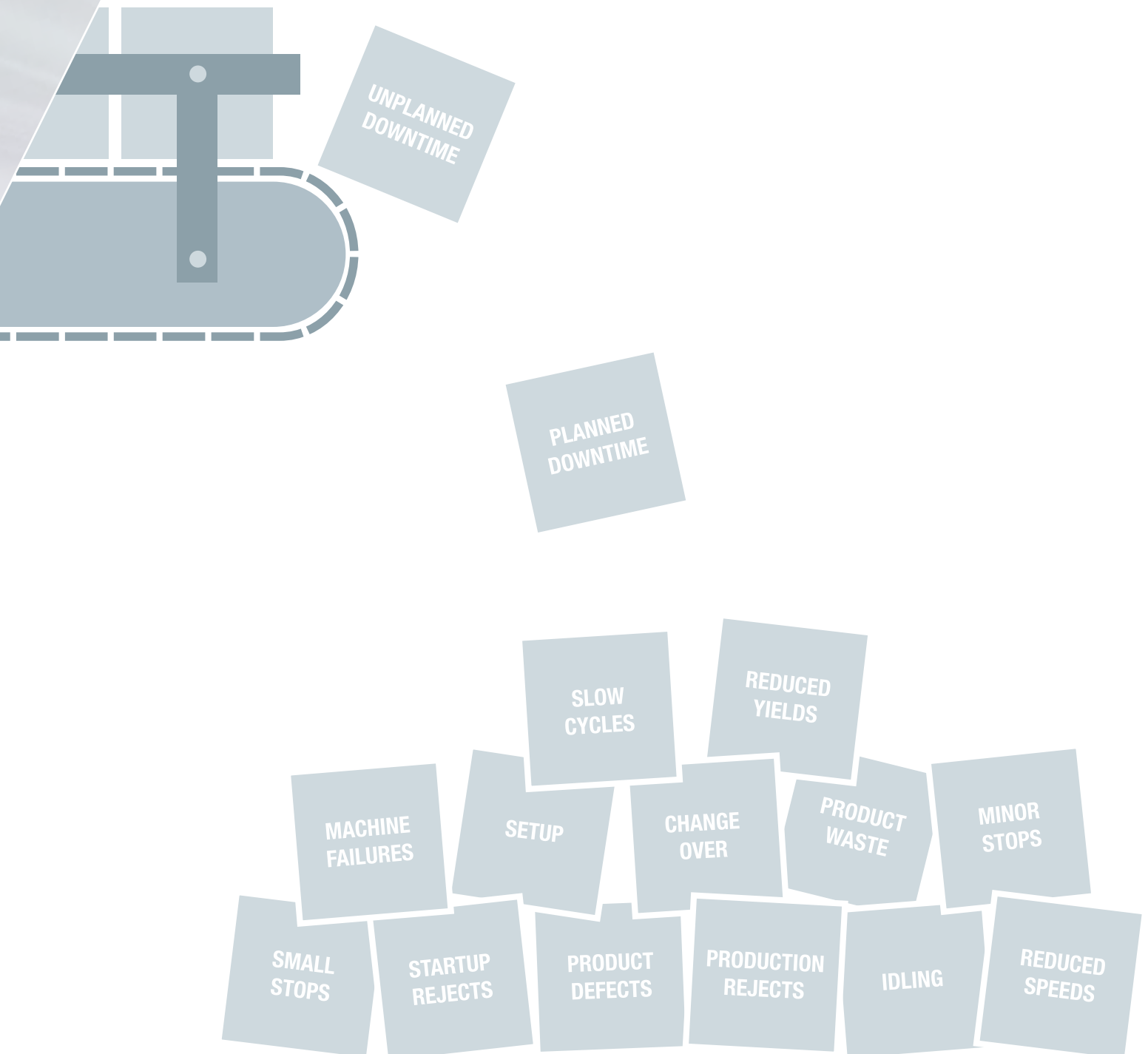
### Expand Performance

Reviewing the causes of small stops and slow cycles can generate insights into the process and help to expand performance. By monitoring the status of key components of the machine, we can identify and eliminate causes of idling, minor stops and reduced machine speed. We can then work to get the machine as close to the ideal cycle time as possible. Expanded performance can be accomplished through an understanding of your goals and reviewing the total cost of ownership of a problem.

### Your Partner

Those who choose Balluff have a long-term partner working with them to improve production. To revolutionize OEE, we use proven automation application areas: controls architecture, format change, predictive maintenance, level sensing, robotic automation and quality assurance. By working together, we can achieve overall equipment effectiveness and efficiency in the machine, the production line and the plant.

UNPLANNED DOWNTIME

PLANNED DOWNTIME

SLOW CYCLES

REDUCED YIELDS

MACHINE FAILURES

SETUP

CHANGE OVER

PRODUCT WASTE

MINOR STOPS

SMALL STOPS

STARTUP REJECTS

PRODUCT DEFECTS

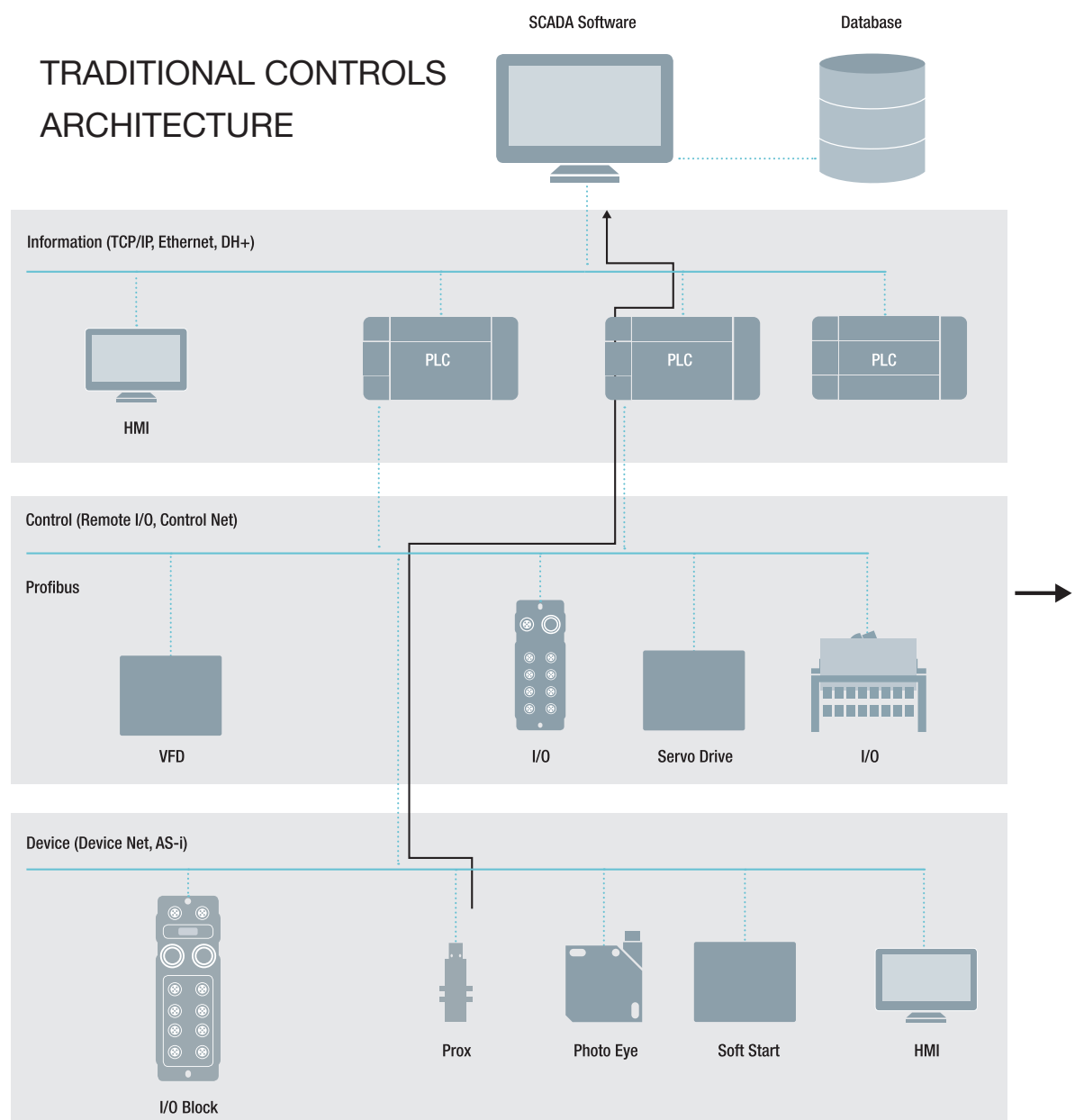PRODUCTION REJECTS

IDLING

REDUCED SPEEDS

# RETHINKING PLANT CONTROL SYSTEMS FOR GREATER VISIBILITY

Many manufacturers in food and beverage operate with a decades-old supervisory control and data acquisition (SCADA) system. For field level devices, sensors and I/O, it is not uncommon to see hardwiring and DeviceNet/Profibus networks. Older generations of SCADA systems rely on difficult to support mainframes, old local area networks (LANs) and process control networks (PCNs).
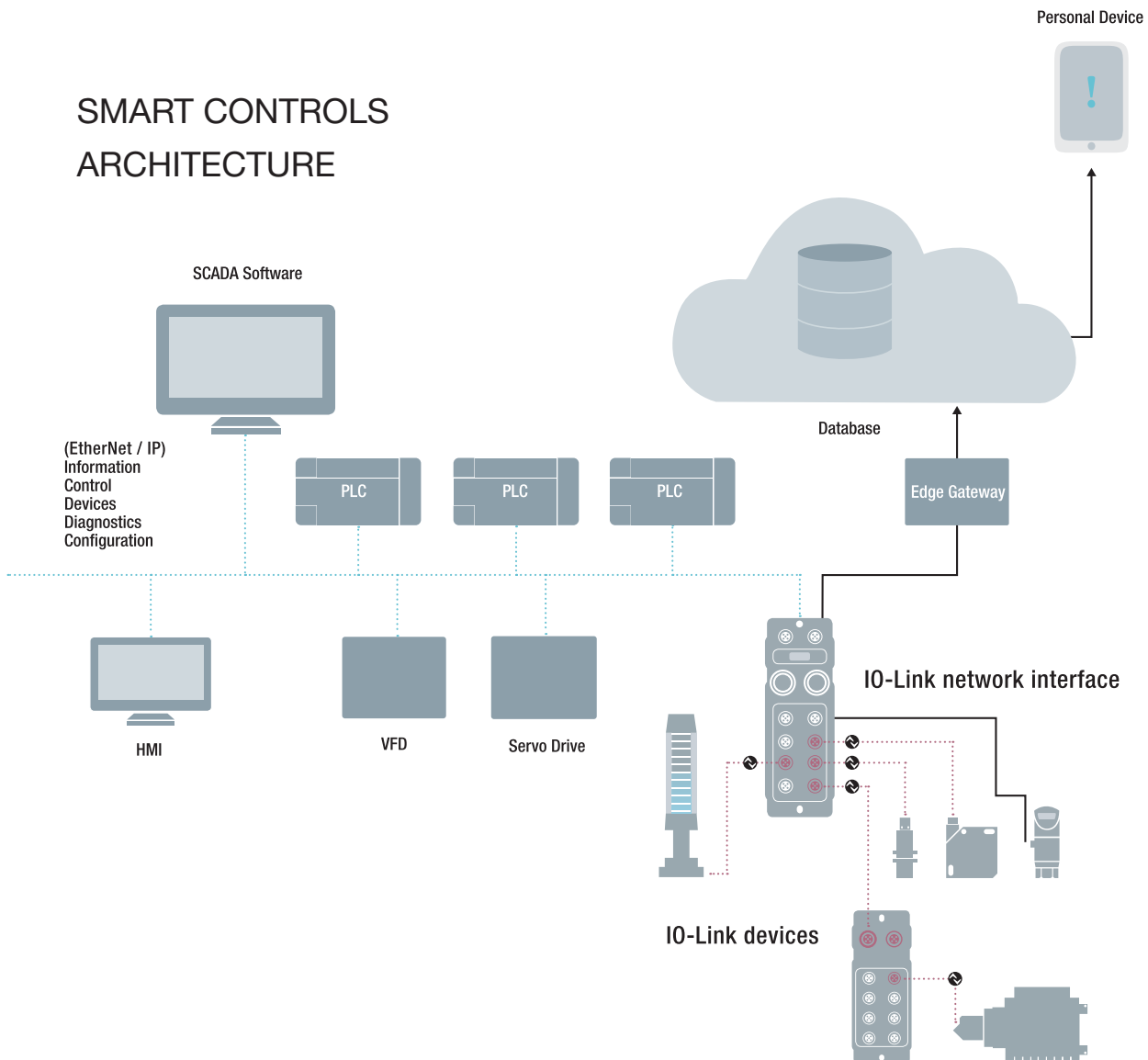
These older SCADA systems can limit overall equipment effectiveness. Newer systems are supportive of smart factory concepts, can be networked and are web-based, creating more flexibility, more efficiency and more visibility into the production processes.

By utilizing Ethernet for the communication between smart devices, PLCs and our SCADA system, we can more easily create visibility into the lowest field level of the process. But it isn't always logical to use an Ethernet infrastructure for a simple inductive proximity switch or photoelectric sensor. The well-established, open-standard IO-Link fills this gap. It simplifies the controls architecture by providing process, parameter and diagnostic data on a single network. IO-Link reduces the number of nodes on a network, reducing traffic and demands on the PLC while simultaneously providing visibility down to the field device.

## TRADITIONAL CONTROLS ARCHITECTURE

SCADA Software

Database

**Information (TCP/IP, Ethernet, DH+)**

HMI

PLC

PLC

PLC

**Control (Remote I/O, Control Net)**

**Profibus**

VFD

I/O

Servo Drive

I/O

**Device (Device Net, AS-i)**

I/O Block

Prox

Photo Eye

Soft Start

HMI

# SMART CONTROLS
# ARCHITECTURE

Personal Device

SCADA Software

Database

(EtherNet / IP)
Information
Control
Devices
Diagnostics
Configuration

PLC

PLC

PLC

Edge Gateway

IO-Link network interface

HMI

VFD

Servo Drive

IO-Link devices

# OEE APPLICATION AREAS.

Overall equipment effectiveness, zero downtime and the demand for shorter production runs is driven by applying innovative technology solutions to create smarter machines. Balluff has responded to the food and beverage market's frustrations with these proven application areas that positively drive uptime and run yield.

**B** *innovating automation*

### TANKS AND STORAGE

- Level sensing
- Controls architecture
- Predictive maintenance
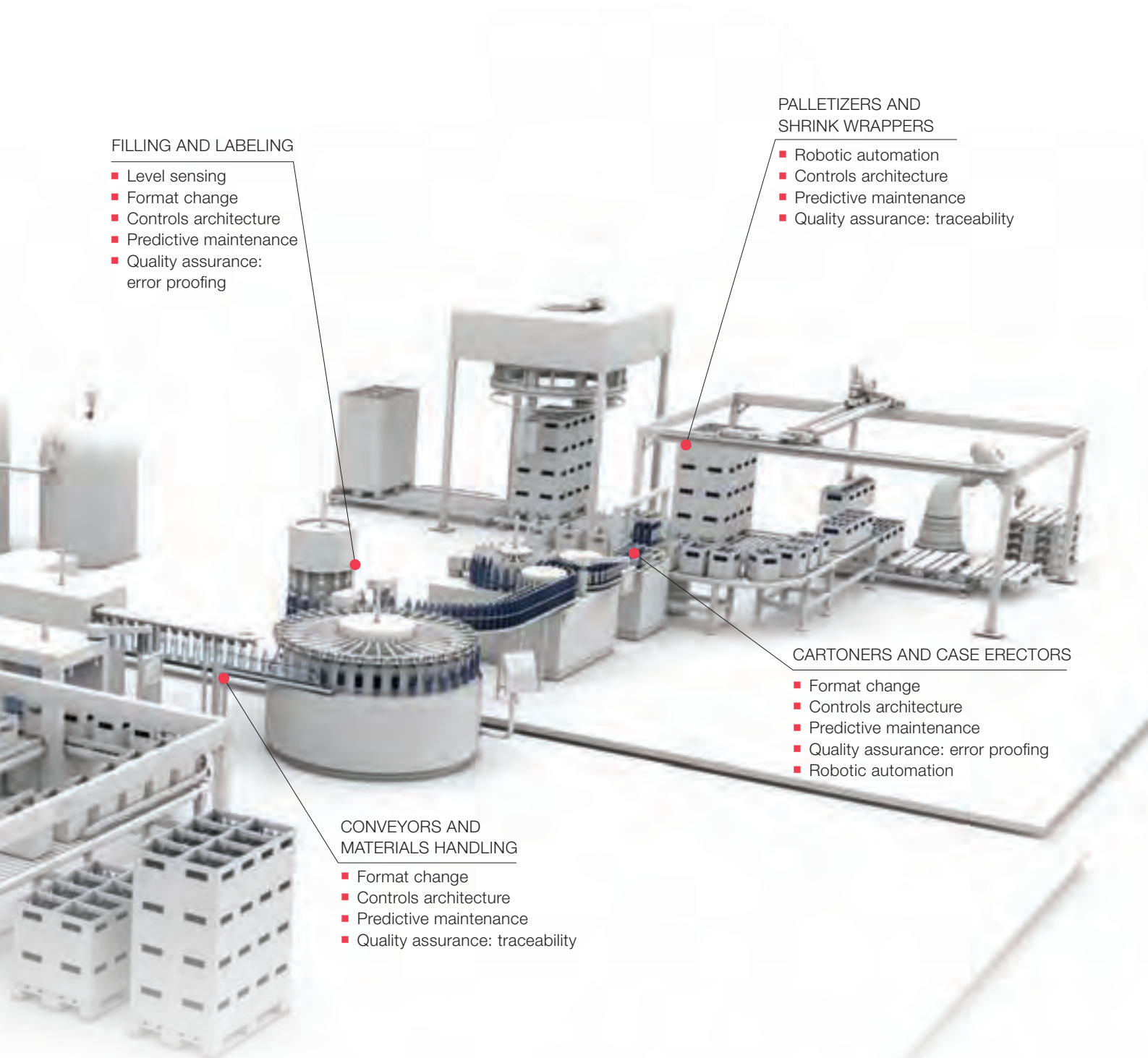- Quality assurance: traceability

### CONTROLS ARCHITECTURE

- Eliminates analog wiring and reduces costs by 15% to 20%
- Simplifies trouble shooting
- Enables visibility down to the sensor/device
- Simplifies retrofits
- Reduces terminations
- Eliminates manual configuration of devices and sensors

### FORMAT CHANGE

- Eliminates changeover errors
- Reduces changeover time, minimizing planned downtime
- Reduces product waste from start up after changeover
- Maintains consistent positioning
- Ensures proper change parts are swapped out

### PREDICTIVE MAINTENANCE

- Enhances diagnostics
- Reduces unplanned downtime
- Provides condition monitoring
- Provides more accurate data
- Reduces equipment slows and stops
- Reduces product waste

## FILLING AND LABELING

- Level sensing
- Format change
- Controls architecture
- Predictive maintenance
- Quality assurance: error proofing

## PALLETIZERS AND SHRINK WRAPPERS

- Robotic automation
- Controls architecture
- Predictive maintenance
- Quality assurance: traceability

## CARTONERS AND CASE ERECTORS

- Format change
- Controls architecture
- Predictive maintenance
- Quality assurance: error proofing
- Robotic automation

## CONVEYORS AND MATERIALS HANDLING

- Format change
- Controls architecture
- Predictive maintenance
- Quality assurance: traceability

## LEVEL SENSING

- Eliminates false triggers
- Conforms to hygienic and FDA guidelines
- Compact design
- Easy to retrofit
- Multi-functional with condition monitoring available

## ROBOTIC AUTOMATION

- Reduces wiring
- Reduces weight
- Integrates with robotics controller
- Simplifies installation
- Connectorless quick disconnect for easy swap-out of end of arm tooling
- Provides continuous diagnostics

## QUALITY ASSURANCE

- Delivers accurate data and reduced errors
- Tracks raw materials and finished goods
- Accurately provides date and lot code for potential product recall
- Allows robust RFID tags to be embedded in totes, pallets, containers and fixtures
- Increases security with access control

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**Improving Effectiveness**

# APPLICATION AREAS.

*innovating automation*

It can be hard to know where to start a process improvement project. Traditional solutions may be working adequately but driving to the next level of improvement seems out of reach. With a focus on applications that solve availability, performance and quality issues, productivity gains can be easily found. Machine builders and manufacturers alike are surprised by the depth of the returns these application areas bring to food and beverage production processes. In this section we will review the most common applications, how they can be applied to improve OEE and provide real world case studies of others' successes.

- Controls architecture
- Format change
- Predictive maintenance
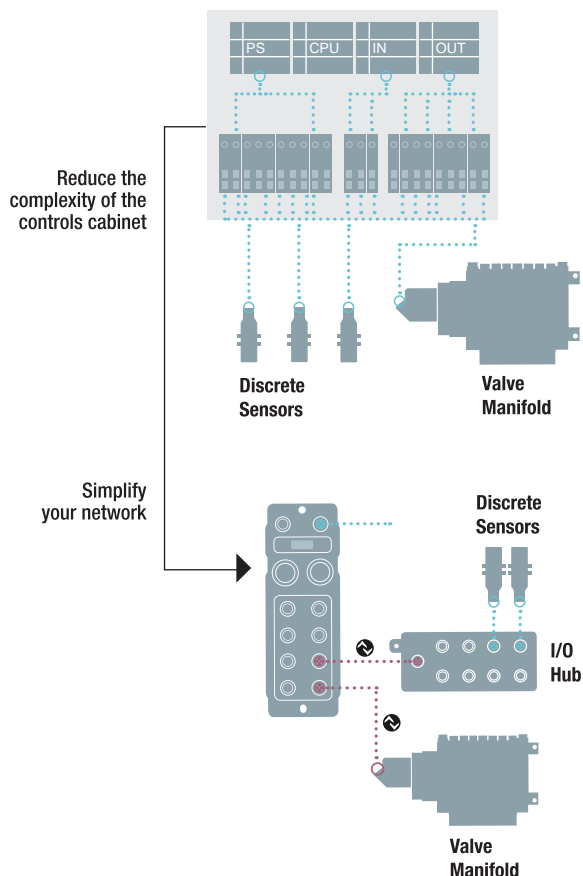- Level sensing
- Robotic automation
- Quality assurance

# CONTROLS ARCHITECTURE

In controls architecture there are many simple improvements machine builders and manufacturers can easily integrate into their processes. For equipment OEMs, there is value in simplifying the controls quotation process, shrinking controls cabinets, maximizing spares, and expediting the build process. For manufacturers, improved controls architecture can simplify the network, allow for faster troubleshooting, reduce unplanned downtime, and can eliminate headaches caused by analog devices. The IO-Link controls architecture provides IIoT-ready applications and easily supports traceability applications. By implementing IIoT, you enable additional value to the other application areas.

## SIMPLIFY DISCRETE WIRING & VALVE MANIFOLDS

Simplify the labor involved in parallel wiring a valve manifold or terminating a set of discrete sensors. Distributed I/O reduces hardware setup, while labor can be customized to reduce I/O hardware costs.

The typical parallel wiring of valve manifolds can be labor intensive and takes up significant cabinet space. OEMs have saved 15-60% per valve in hardware, engineering and labor costs by switching to IO-Link valve control.
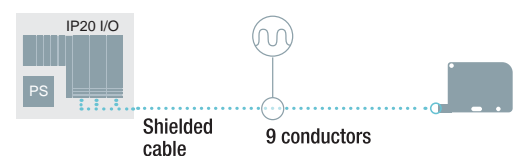
## SAVE ON ANALOG WIRING AND INTEGRATION

When using analog devices on a machine it can be difficult to find a path for the shielded cable that does not incur noise from motors or other complications. By putting the analog I/O right at the signal's source, the complications and costs can be reduced by 15-20%. Utilizing IO-Link, the analog to digital conversion is done inside the device, and a standard sensor cable delivers noise-free feedback. In addition, the smart device reports engineering units (mm, PSI,°C) which reduces the effort to program and integrate.
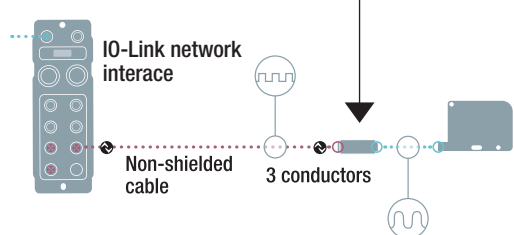
Reduce the complexity of the controls cabinet

PS CPU IN OUT

Discrete Sensors

Valve Manifold

Simplify your network

Discrete Sensors

I/O Hub

Valve Manifold

Traditional Analog I/O

Analog output – measuring signal and set points

IP20 I/O

PS

Shielded cable

9 conductors

IO-Link Analog I/O Interface

Analog to digital conversion

IO-Link network interace

Non-shielded cable

3 conductors

IO-Link Analog Smart Sensor

Analog to digital conversion
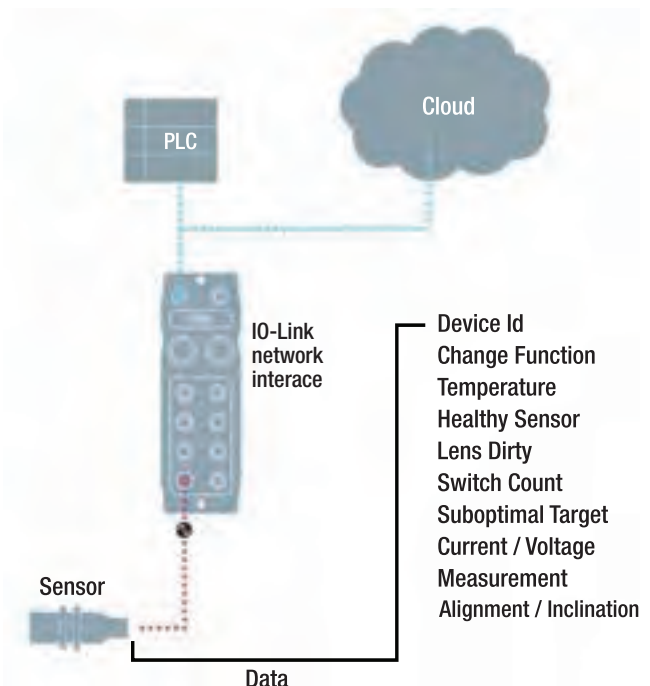
IO-Link network interace

Non-shielded cable

3 conductors

GAIN FLEXIBILITY AND EXPANDABILITY

By using existing equipment infrastructure and networks, controls architecture utilizing IO-Link reduces costs of wiring, labor and control panel size. Any combination of vendors can be utilized between masters and devices. With discrete I/O hubs, up to 480 I/O points can be used with one IP address connection to the PLC. And with an open IO-Link master port available, future expandability or error-proofing solutions can be easily integrated into the machine with unlimited possibilities.

VISIBILITY DOWN TO EACH SENSOR

Controls architecture is about connecting devices in a smarter way on the plant floor. These connections deliver new ways to generate and collect useful data. By providing visibility into the process, IIoT allows for significant improvements, including more predictive maintenance and data analytics. With IO-Link you can create visibility down to each sensor and gain the flexibility and reliability needed for sustainable growth in the global market. Data can be captured, and the resulting analytics can be used to drive decisions.

UNLIMITED POSSIBILITIES

Discrete I/O

RFID Identification

Smart Sensors

Smart Indication

Cloud

PLC

IO-Link network interace

Sensor

Data

Device Id
Change Function
Temperature
Healthy Sensor
Lens Dirty
Switch Count
Suboptimal Target
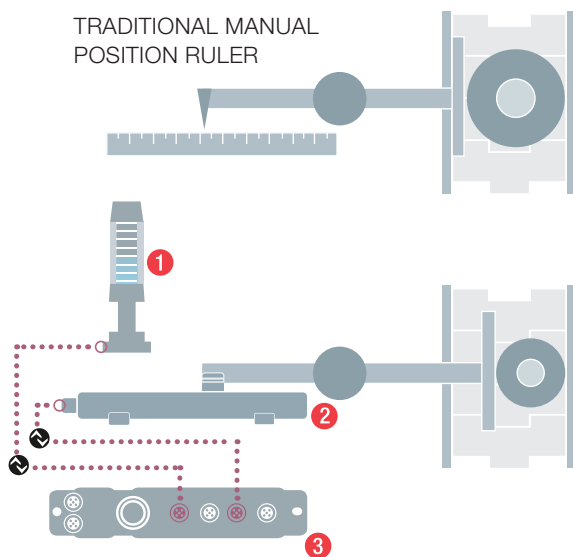Current / Voltage
Measurement
Alignment / Inclination

# FORMAT CHANGE

Many factors can impact availability during a production line format changeover, including incorrect settings, mismatched change parts, obstructed product flow, blocked sensors, machine tweaking, and slow startups. Using automation technology ensures proper change parts are present and guiderails are set to their proper distance. Operators can be guided to make consistent, accurate and quick changes to the format of the machine, reducing planned downtime and shrinking startup waste.
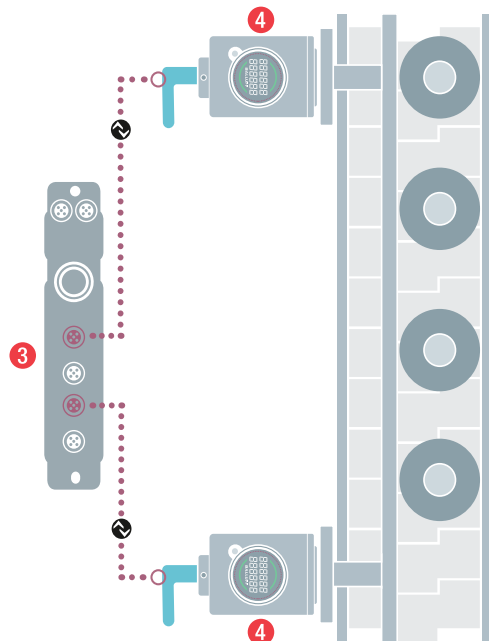
GUIDED FORMAT CHANGE - LINEAR

When manually changing the format of the machine, workers often use visual marker ticks or flags to set the machine. But these can create errors and require lengthy startup times. In applications with operator guidance, visual feedback and position measurement sensors reduce downtime time and ensure position accuracy. Guided format change technologies provide the operator visual cues to guarantee proper setup, thereby reducing startup waste and operator training.
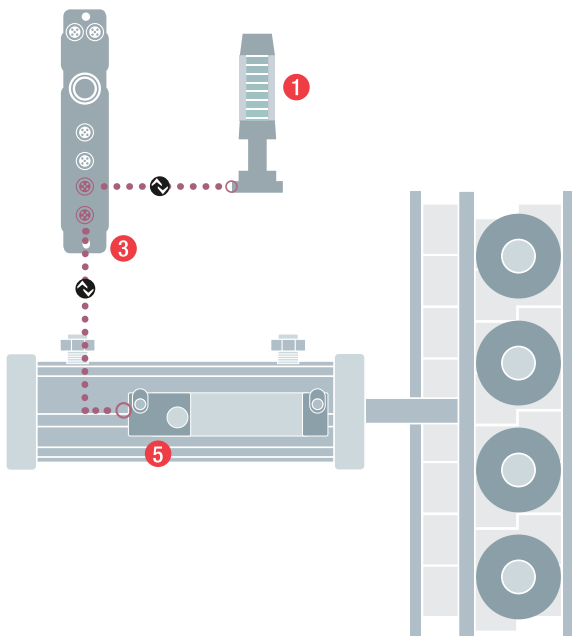
GUIDED FORMAT CHANGE - ROTARY

Digital position indicators are commonly used to provide operator feedback in guided format change applications. Hand cranks and wheels are used to adjust guide rail positions, modify equipment heights and adjust the automation for each format the equipment is designed to accommodate.The smart rotary devices are programmed to instruct the operator on the proper position and guarantee perfect setup at each changeover event. By providing visual cues at the change-point and feeding values to the control via IO-Link, the guided format change can reduce issues at startup.

TRADITIONAL MANUAL
POSITION RULER

**1**   BNI SmartLight tower light
**2**   BTL Linear position sensor
**3**   BNI slim IO-Link network interface

**4**   BDG Digital position indicator
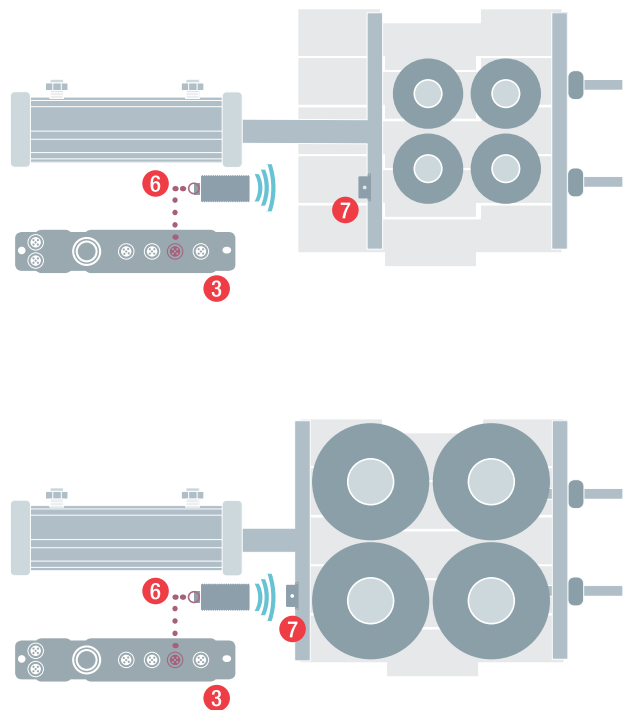
AUTOMATIC SIZE CHANGE

Machine OEMs want to reduce the changeover time of their machine. Electric motors and pneumatic actuators with closed loop sensor feedback are the main tools for achieving significantly faster changeovers. By using automatic size change, accurate positions can be quickly achieved every time. And with IO-Link, integration is simplified. Add-on packages can be offered, and analog headaches are removed. A variety of linear and rotary position sensing technologies are available to best fit to each changeover application, ultimately preventing machine crashes and eliminating waste at startup.

CHANGE PART IDENTIFICATION AND VALIDATION

Many format change applications require the machine operator to replace hardware with different components. A change in recipe or package size can require plates, rails or guides, pusher arms, flap folders, pickup frames or tape heads to be changed. These parts can look very similar from package to package. RFID tags can be used to identify and validate all correct mechanical change parts are installed before startup. For OEMs, this can ensure only branded change parts are utilized with the machine to maintain the warranty. Industrial RFID eliminates mistakes and machine crashes, and guarantees fast and easy startup.



**5**   BMP Magnetic position sensor

**6**   BIS IO-Link RFID read/write head
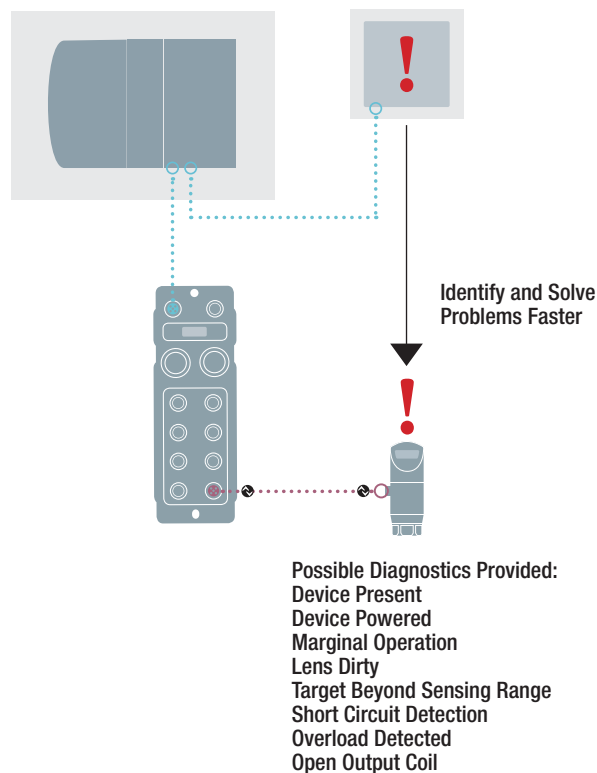**7**   BIS RFID data carrier tag

# PREDICTIVE MAINTENANCE

In most facilities, maintenance crews and operators typically only respond to problems only after it causes a production stop or quality. Hard stops due to component failure can cause long downtimes and major repair efforts. And most problems occur in spite of regular preventative maintenance routines. By using smart sensors, diagnostics, event data and condition monitoring, you can reliably detect or predict equipment or components failure before a catastrophic downtime occurs. Predictive maintenance efforts can dramatically improve OEE of equipment by reducing unplanned downtime events.
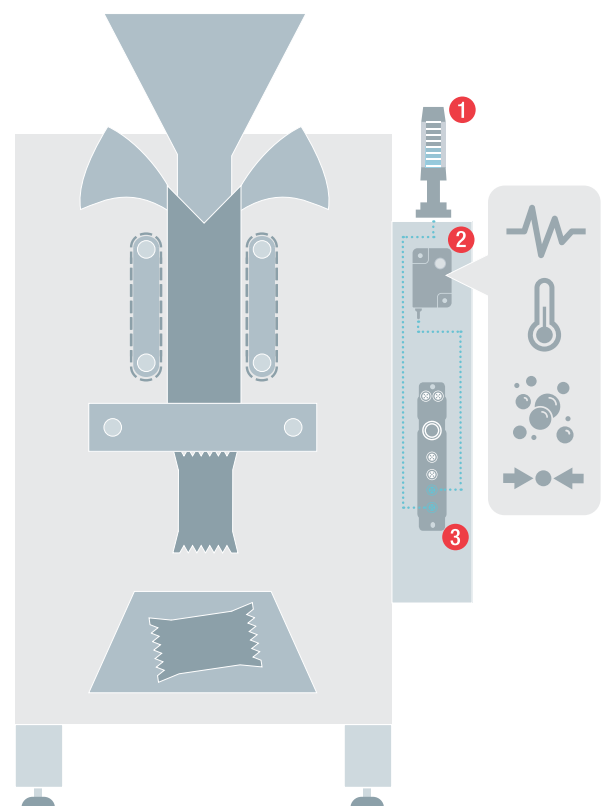
## DEVICE DIAGNOSTICS & EVENT DATA

Many sensors and automation components work well until they don't. There is little to no warning that a failure and downtime are going to happen. Intermittent failures or poor detection quality can cause nuisance stops and slow production runs. Smart sensors and devices with IO-Link provide improved visibility and make maintenance tasks more accessible, keeping the equipment running with the best efficiency. Diagnostics provided by the individual intelligent devices highlight impending problems and speed recovery. Operators can provide technicians exact details of the failure, saving pricey repair time.
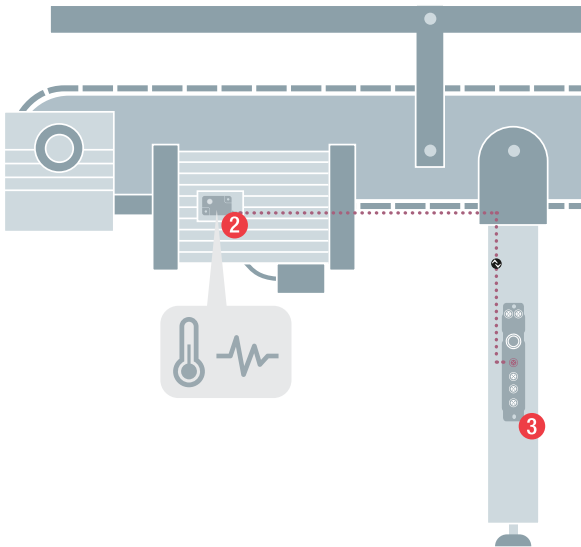
## MACHINE CONDITION MONITORING

OEE is a measurement of the effectiveness and efficiency of a production machine's availability, performance and output quality. Using condition monitoring data allows us to correlate production events to changes in OEE. This data, along with long-term trends and statistical evaluation of the machine's condition, can predict future failures or detect production issues before they become major downtime events. Monitoring machine states like vibration, humidity, temperature or ambient pressure gives key insights into machine health before an event occurrs. Predictive maintenance activities can then be performed during changeovers or scheduled shutdowns, eliminating unplanned downtime and premature stops during production.

**Identify and Solve Problems Faster**

**Possible Diagnostics Provided:**
**Device Present**
**Device Powered**
**Marginal Operation**
**Lens Dirty**
**Target Beyond Sensing Range**
**Short Circuit Detection**
**Overload Detected**
**Open Output Coil**

1  BNI SmartLight tower light
2  BCM Condition monitoring sensor
3  BNI Slim IO-Link network interface

## DEVICE CONDITION MONITORING

Major pain can come from failure of individual components like bearings, linear drives, spindles, motors, gearboxes, or auxiliary units like fans and compressors. Continuous condition monitoring of the status and health of these components can eliminate many failure states like worn bearings, belt buckling, frictional rubbing, part chatter, unbalance, loose bolts, or soft foot. This data can help predict failures and provide true improvements to OEE by reducing unplanned machine downtime due to mechanical failures and increasing component life.

## DIGITALIZATION, VISUALIZATION AND IIOT

When doing projects with smart sensors and condition monitoring, it can be challenging to determine predictive maintenance calculations and trending. It can also be challenging to efficiently bring data together from multiple systems. With a goal to increase your productivity, we help with providing the right data in order to create visualizations for your predicitive maintenance applications. Finding a partner to help you collect all production-relevant data, support technical implementation tasks and build application-specific solutions is a viable option for overwhelmed plant floor engineers and maintenance teams.
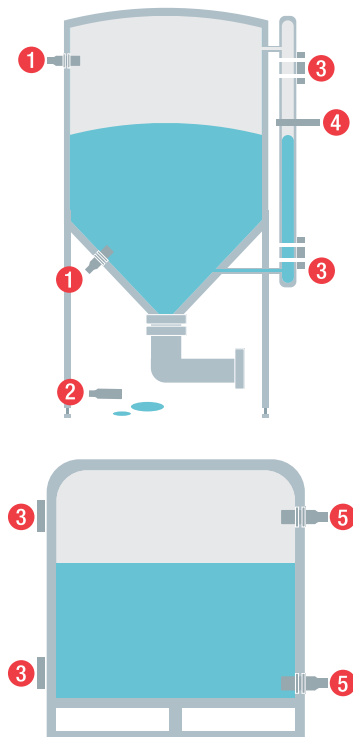
# LEVEL SENSING

In food and beverage applications many raw materials are stored and moved through the plant. These can include a variety of textures, powders, liquids, viscosities, and bulk solids. Many plants rely on operators to maintain process tank levels by manually looking into manways and ports, instead of using more reliable level sensing technologies. Without sensing on tanks, processes can run dry without an operator's knowledge, and waiting for new deliveries can halt production for hours or even days. When filling, tanks can overflow, creating hazards and material waste in the work areas. The ability to reliably measure all materials in storage containers is key to driving higher OEE through maintaining the quality of product produced and expanding performance of the line.

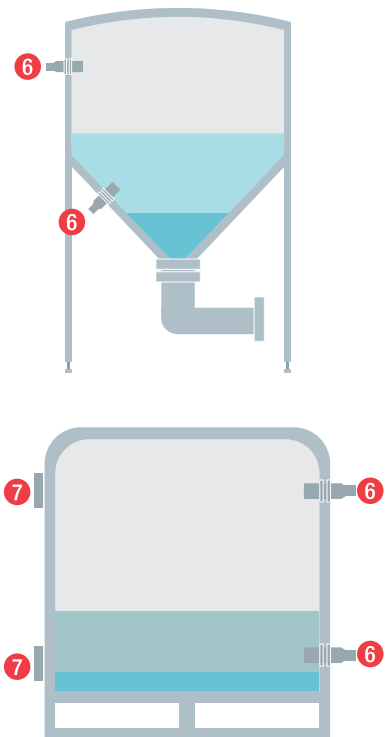## DISCRETE LOW AND HIGH LEVELS IN TANKS

Running out of material mid-production can cause high volumes of scrap product and wasted production time. In a manual process, additives, seasonings, or other key ingredients could run empty if an operator fails to verify material quantity. Discrete sensors provide reliable limit levels for tanks and containers. High and low points can be tied to a pump controller for automatic refilling when low and turning off when full. Detection on stainless tanks can occur through a port using capacitive sensors or without media contact using a sight glass and capacitive or photoelectric technologies. Leak detection is also possible using capacitive technology. Levels in a plastic tank are typically measured without media contact through the wall of the tank or by using switch-wells.

## STOP PROBLEMS CAUSED BY FOAM AND FILM

Standard capacitive technology is not ideal for detecting all materials. Foam, film, product build up, and residual dust can trigger false level detection. High viscosity liquids can be difficult to sense reliably using traditional devices. However, excellent smart level hybrid capacitive technologies can be used to reliably measure conductive materials. They provide outstanding compensation properties with respect to deposits, filming and foaming.

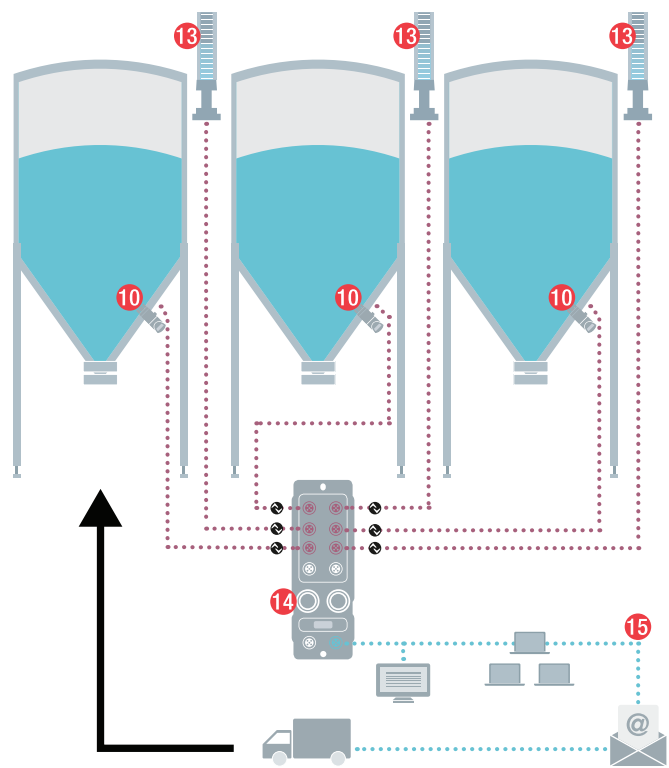| | |
|---|---|
| **1** BCS Capacitive level sensor | **6** BCS Hybrid smart level sensor |
| **2** BCS Leak detection sensor | **7** BCS Hybrid flatpack smart level sensor |
| **3** BCS Capacitive flatpack sensor | |
| **4** BGL Photoelectric fork sensor | |
| **5** BAM Switch well for capacitive sensors | |

## CONTAINER AND TANK MONITORING

It is often more advantageous to know exactly how much material is in a tank or container. This can be achieved with a variety of measurement and level sensing sensors. In a stainless tank, hydrostatic pressure sensors could measure from the bottom of the tank, while ultrasonic sensors could use sound waves to measure levels from the top. Linear position sensors with a float could even be used under strict hygiene guidelines. Self-adhesive capacitive strip sensors measure levels in non-metallic containers without contacting the media. Each solution provides awareness of the exact volume of material remaining and can signal possible material shortage setbacks.

## LEVEL VISUALIZATION AND AUTO-REPLENISHMENT

In level sensing applications it is helpful for operators and supervisors to easily discern tank levels. Level indication lights provide simple visualization of each tank's status. Capabilities for monitoring and visualizing tank levels is easily possible with IO-Link smart devices and customized dashboards through integration services. In addition, solutions are available that allow for tanks to be monitored in a dashboard using smart sensors, shared with the SCADA system, and visualized at the tank using a light. They can even provide automated material replenishment to ensure production never runs dry.



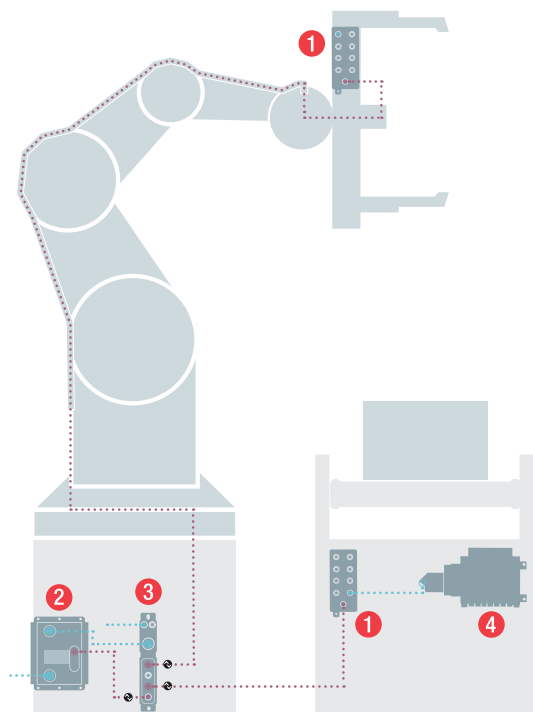| | |
|---|---|
| **8** | BUS Ultrasonic measurement sensor |
| **9** | BTL Linear position sensor with float |
| **10** | BSP Pressure measurement sensor |
| **11** | BCS Capacitive strip sensor |
| **12** | BAE Capacitive sensor amplifier |

| | |
|---|---|
| **13** | BNI SmartLight tower light |
| **14** | BNI IO-Link network interface |
| **15** | BAI Software and solutions |

# ROBOTIC AUTOMATION

Demands for automation and workforce shortages are driving record use of robots in food and beverage manufacturing. And as we work to improve OEE in the plant, there are many tools that can be used. With robots, reducing idle time and increasing work time is a key to gaining a return on investment. By using inductive coupling and light-weight remote input/output devices, fully automatic tooling changes can be executed even with pneumatic solenoids on the end-effector. Traditional grippers are improved by utilizing smart sensors which provide diagnostics and allow for automatic parameter modifications in format changeovers. Sensors, networking, vision, and IO-Link devices dramatically improve the effectiveness of robotic equipment, boost robot utilization and increase flexibility of applications.

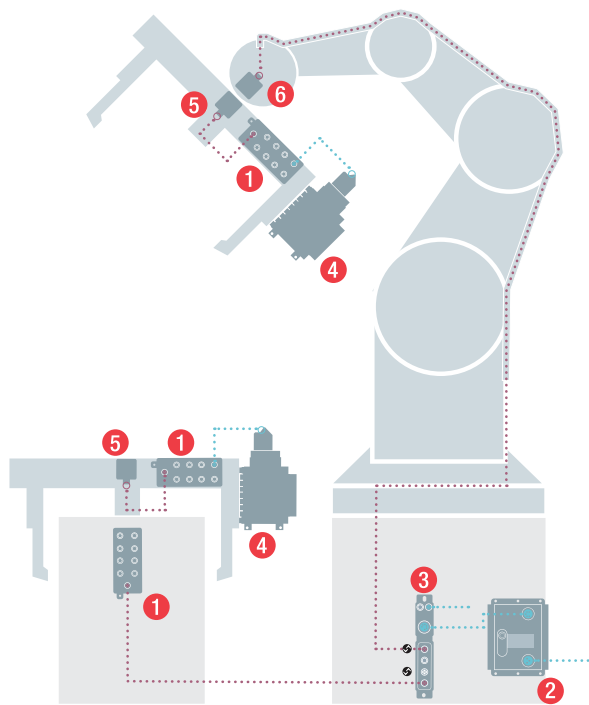## CONNECT SMART I/O DIRECTLY TO THE ROBOT

The more we automate, the more complex the controls architecture and wiring can feel. Internal dress packs have limited conductors available for sensor and actuator signals. Robotic integrators have realized that IO-Link smart devices are vendor agnostic and can be used directly with most modern robot controllers without interfacing first with an automation PLC. This direct connection can quicken process times and simplify the controls architecture. In addition, with only 3 to 5 wires, an IO-Link signal can be used to control dozens of sensors and pneumatic solenoids on the end-effector, including diagnostics and automatic format change parameterization capabilities. By utilizing IO-Link I/O hubs to simplify inputs and outputs, robotic automation applications are more flexible and effective.
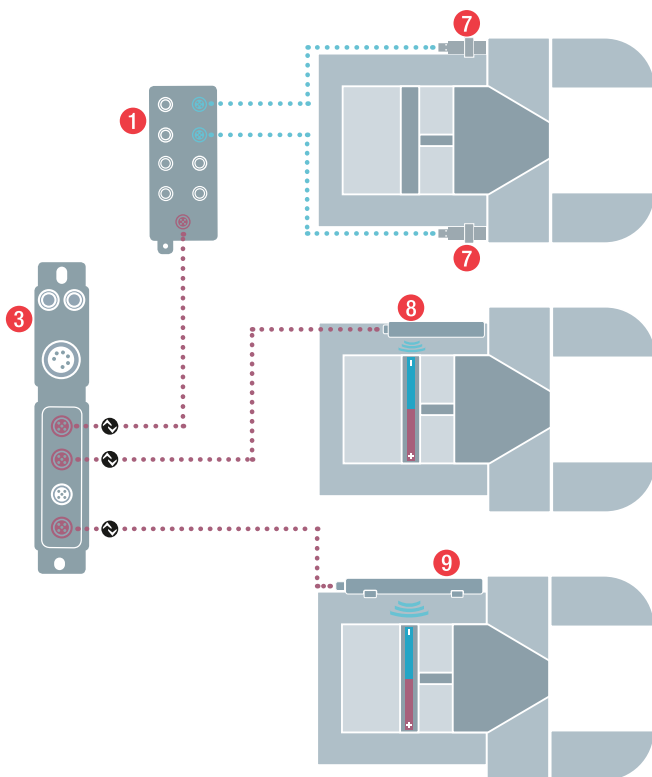
## FAST AND AUTOMATED TOOLING CHANGES

Robots capable of multiple tasks or recipes can dramatically expand the performance of the production. With inductive coupling, power and signals are sent wirelessly without contact across a small airgap from the arm to the tooling; and it boots quickly! Solenoid valves are controlled on the end-effector reducing the number of airlines to couple. Sensor signals are collected with an IO-Link sensor input hub allowing for only a few conductors to carry the tool ID and many sensor signals to the control. Inductive coupling I/O technology allows for fast tooling changes of the end-effector of the robot, reducing idling and shortening planned downtimes.



| | |
|---|---|
| **1** | BNI IO-Link discrete I/O hub |
| **2** | BAE PS Heartbeat power supply |
| **3** | BNI IO-Link network interface |
| **4** | BNI IO-Link valve manifold connector |

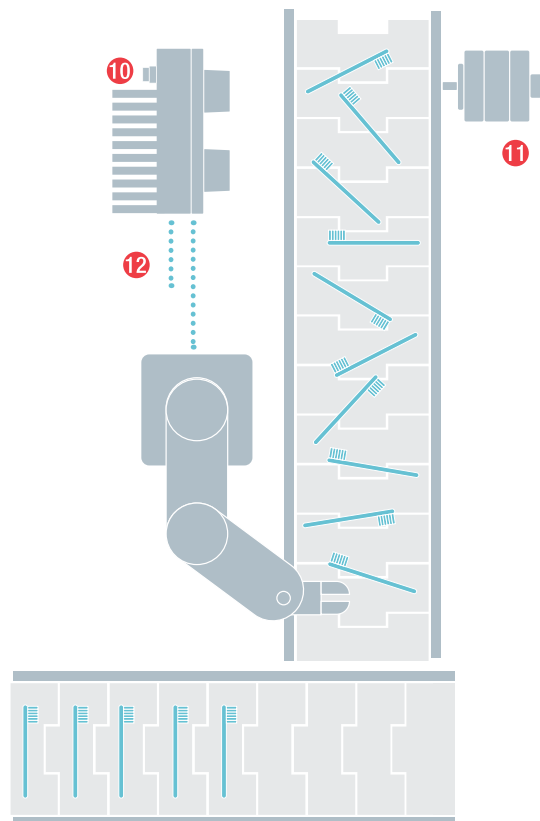| | |
|---|---|
| **5** | BIC Inductive coupler remote |
| **6** | BIC Inductive coupler base |

CREATING SMART GRIPPERS WITH SMART SENSORS

Sensors are not often used in traditional pneumatic gripper applications. Proper function is assumed. This can cause unnecessary collisions or process failures due to stuck/worn mechanical components, leaks in the pneumatic lines, or small variations in the process cycle. Adding sensors to the gripper creates a closed loop and discrete open/closed feedback. This is done by detecting the jaw with an inductive sensor or detecting the piston magnet with a magnetic field cylinder sensor. By using position sensors, the exact gripper jaw position is known and used to measure or identify the object in the jaws. With smart sensors, application diagnostics can be reported to dramatically improve the capabilities of the robot end-effector.

VISION GUIDED ROBOTS

In applications where machine outputs are randomized and need to be organized, robots are utilized for pick and place of the objects. This requires machine vision to determine an item's presence and position on the conveyor. With a moving conveyor tied to an encoder axis, the robot picks product on the move, or the conveyor can be controlled so the parts are picked from a stationary position. Generally, 3D cameras are used to provide the position feedback. By utilizing machine vision for robot guidance (VGR), the robot knows what to pick when.

| 7 | BES Inductive mini proximity sensor |
| 8 | BMF Magnetic field discrete sensor |
| 9 | BMP Magnetic field position sensor |

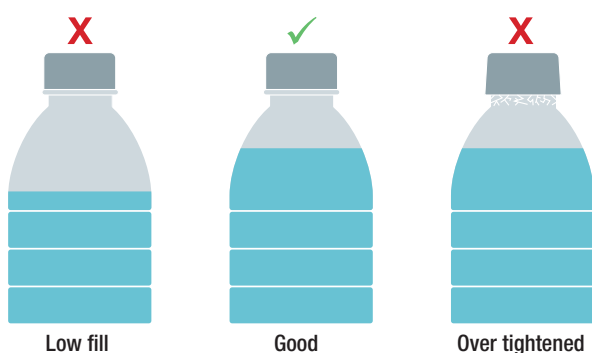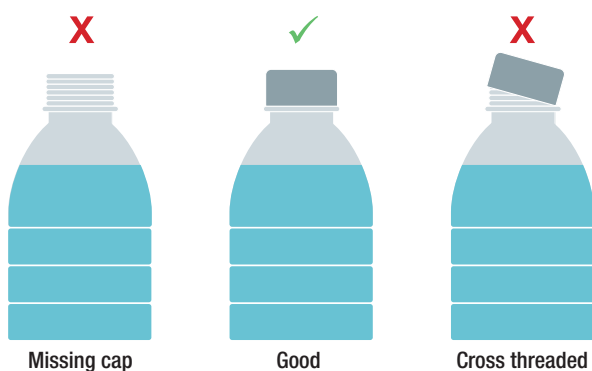| 10 | Matrix Vision 3D Camera |
| 11 | BDG Rotary Encoders |
| 12 | BCC Power and network cables |

# QUALITY ASSURANCE

It is important to identify and prevent defects before they reach the consumer. This can be challenging depending on the company's quality assurance principles, and how the company limits human error. Quality assurance departments work to meet standards and legal requirements, provide record keeping, create reporting, and solve problems. For true OEE value to be realized, it is also essential to inspect and monitor product as it is being produced, record the cause for deviations, and track uptime, output and waste. By implementing error proofing and traceability applications, you can reduce recalls, minimize losses, enhance food safety and produce product with less stress.
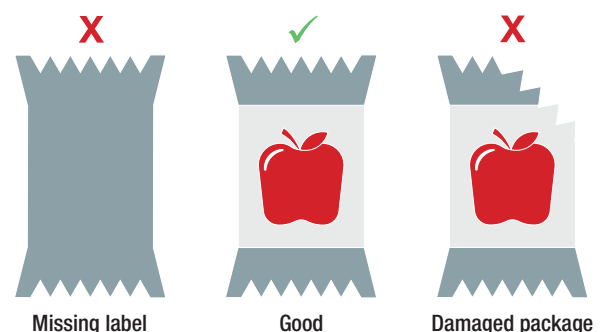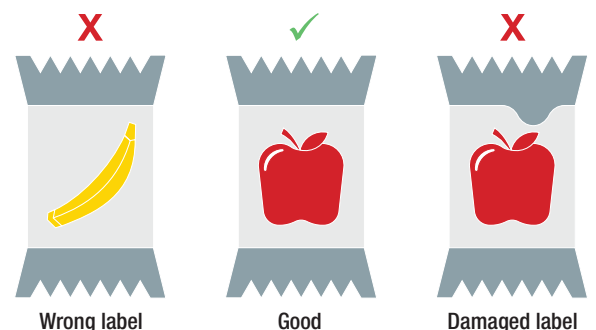
## ERROR PROOFING IN FILLING AND BOTTLING

In filling and bottling processes the sealing/capping process is a critical step. Missing caps, cross threading, and over tightening cause downtime and create waste. Ensuring the exact fill level is another vital process, and even a legal requirement in some plants. Many manufacturers realize quick improvements in OEE by implementing error proofing automation with sensors to identify any defects and enhance quality assurance initiatives.
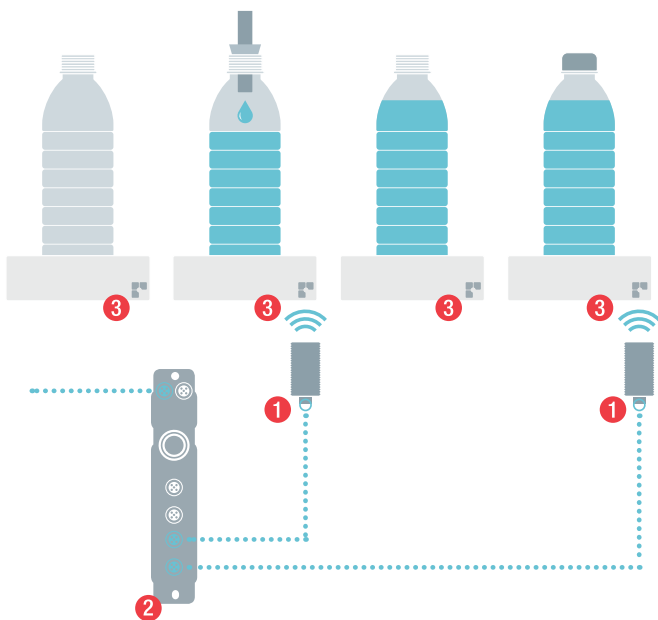
## IN PROCESS QUALITY CONTROL

When implementing quality control, we identify defects in the product and remove them from production before they reach the consumer. Manufacturers identify critical processes and implement automated checks, using sensors to prevent potential defects from being repeated. Damaged product and packaging and problems with labeling create unnecessary waste. Error proofing measures provide visibility into problems and make it easier to create follow-up actions. Manufacturers who implement strong quality control solutions in the production process typically realize higher throughput in production runs.



| Missing cap | Good | Cross threaded |
| --- | --- | --- |

| Wrong label | Good | Damaged label |
| --- | --- | --- |

| Low fill | Good | Over tightened |
| --- | --- | --- |

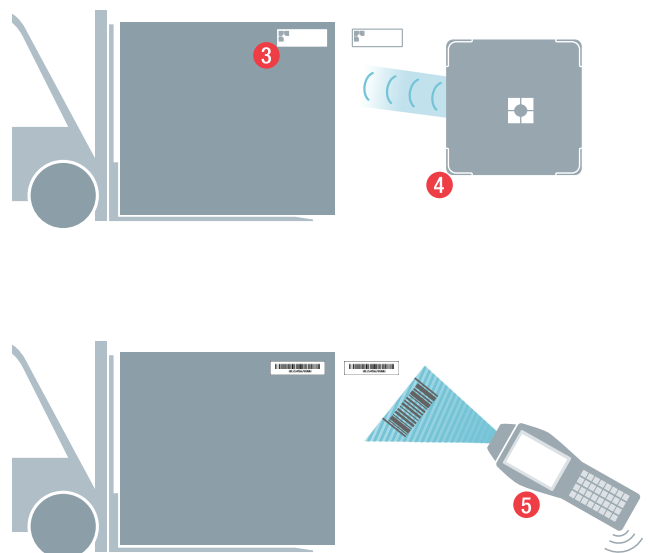| Missing label | Good | Damaged package |
| --- | --- | --- |

TRACK AND TRACE IN PRODUCTION

Some products require detailed information of the production processes to ensure traceability of the work and raw materials used. When this is needed, industrial RFID systems are utilized for work in process (WIP) tracking of the production activities. The product carrier or transport is affixed with an RFID data tag that contains detailed information about the production such as who did the work, when the work was completed, or what batch of material was used to make the product. Every action has data making it possible to find and contain defects quickly.

TRACEABILITY OF REUSABLE CONTAINERS

As raw materials and ingredients in a plant are commonly loaded into reusable containers, the ability to store information with this material is critical for safety and reduces the level of waste in the plant. Industrial RFID systems allow the reusable containers to be tagged and tracked. Time stamps, type of material and product movements are reported to the MES system; while critical processes, like cleaning cycles and spoilage times, are also monitored. RFID gateways or handheld barcode scanners can be used to track where a bin was stored, making it easier to find and ensuring that the proper material is used at the proper production location. Traceability in the factory for reusable containers minimizes economic losses and improves food safety.



| 1 | BIS IO-Link RFID read/write head | 4 | BIS UHF Read/Write system |
| 2 | BNI IO-Link network interface | 5 | BIS Portable Barcode Reader |
| 3 | BIS RFID data carrier tag | | |

**Creating Success**

# CASE STUDIES.

B *innovating automation*

With a focus on improving production efficiencies in food and beverage factories, machine builders and manufactures have implemented new technologies. A review of our partnerships over the decades shows the teams who have more effectively boosted productivity implemented one or more of the previously mentioned applications areas into their equipment. In many of the case studies presented here, the controls architecture application area with IO-Link plays a foundational role in the value created in the solution. The following real-world examples show how partnering with Balluff and leveraging the application areas can dramatically improve availability, expand performance and enhance product quality.

- Controls architecture
- Format change
- Smart sensors
- Quality assurance

SAFETY, CONTROL, CONFIGURE AND MONITOR

During its search for a solution to handle the safety system of its new VisionPak™ vacuum pack machines, CP Packaging also sought out smart factory concepts to drive efficiencies and growth. The company, a producer of horizontal form fill and seal machines in Appleton, Wisconsin, needed tools to both protect its staff and allow workers to configure, control, and monitor that system. IO-Link controls architecture from Balluff delivered the benefits of Balluff's safety system solution and the efficient handling and configuring of analog and digital devices into the system. Safety over IO-Link solutions combine automation and safety to deliver more efficient production while protecting staff and equipment.

# Controls Architecture Case Studies

In machine building, costs can come from many parts of the process — engineering, cabinet design, cabinet build outsourcing, machine assembly and machine commissioning, and more. Opportunities abound for cost overruns and delays. With controls architecture utilizing IO-Link, machine builders and in-house retrofits at manufacturers benefit from easier development and engineering efforts. Time to build and commission new equipment allows for more machines to be built and more projects to be completed with the same people and resources. Controls cabinets shrink in size and condensed machine footprints allow for more production in less space.

SIMPLIFY HYGIENIC MACHINE CONTROLS ARCHITECTURE

To meet the demands of customers wanting smaller, more efficient machines that also meet all sanitary and hygienic design requirements, Triangle Package Machinery Company sought two solutions in one. The company, a Chicago-based producer of vertical form fill seal machines primarily for the food packaging industry, incorporated IO-Link controls architecture and sensors from Balluff into their new Compact Sanitary Bagger (CSB) machine to simplify the machine and controls architecture. The incorporation of IO-Link from Balluff allowed them to significantly reduce the footprint, improve sanitary features, and enable ease of maintenance in their latest modular machine design.
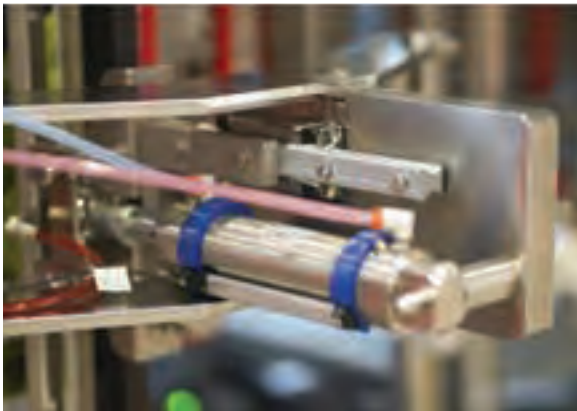
# Format Change Case Studies

The time spent on manual changeover of a production line due to product changes, packaging changes or size changes can have a significant impact on the overall efficiency and effectiveness of the equipment. Changeover not only requires physical adjustments, but also needs a slow ramp-up to ensure proper configuration and product quality. Material jamming or waste product can cause longer and unexpected downtime. Automation technology used in format change can dramatically reduce the downtime and losses between production runs.



CHANGE PART VALIDATION WITH RFID

When Edson Packaging, part of the ProMach group, discovered their customers needed to reduce changeover time to allow for more size changes per shift, they developed servo adjust automated format change technology. By using industrial RFID with this system, Edson was able to eliminate potential human errors and reduce the machine changeover time from thirty minutes to just five. The RFID system allows the machine to track and manage change parts and recognize whether the proper tools are installed during setup. In addition, data such as part descriptions, recipe information and tool management data allowed customers to share tools between machines, automatically identify size change recipes, and incorporate predictive maintenance.

## SIMPLIFIED SETUP FOR SIZE CHANGE

With Triangle Package Machinery's Compact Sanitary Bagger, the setup of the machine was simplified using automation components for machine adjustments due to bag size being changed. An IO-Link position sensor was added on the back-seal cylinder, which would have been cost prohibitive using traditional analog sensors. By using a cylinder with a position sensor, Triangle was able to redesign the back-seal assembly and simplify the set up, which requires the bag size to be changed and the forming tube to be swapped out. In addition, this lets the operators to better monitor the speed at which the bagger operates and the consistency of the seal time. Triangle added a continuous sensor so customers can monitor the sealing time, a critical parameter, over the whole range without needing to change the hardware configuration when the forming tube is changed.

PLANT-WIDE IMPLEMENTATION OF INDUSTRY 4.0 CONCEPTS

One of the largest ice cream producers in the world, Helacor S.A., sought technology to enable their Industry 4.0 factory concept. They wanted to retrofit existing equipment to produce more ice cream while also maintaining product quality and gaining deeper visibility into troubleshooting downtime. For this, engineers at Helacor chose IO-Link machine mount controls architecture. This allowed them to dramatically reduce wiring and eliminated issues caused by cleaning processes that stemmed from damage to traditional I/O and junction boxes. IO-Link also provided detailed information from a variety of smart sensors and smart devices. They integrated this data into the SCADA system and developed predictive maintenance practices. Through this process, Helacor improved production output, enhanced visibility and reduced unnecessary downtime.

# Smart Sensors
# Case Studies

Automation technologies are bringing real value to manufacturers interested in improving their efficiency, adding flexibility and expanding visibility in the plant. Demand for food and beverage products has grown in both variety of product and style of packaging, creating a need for flexibility. Smart factory solutions are more reachable than ever before, with robotics automation, controls architecture and predictive maintenance applications leading the way.

COBOT GUIDANCE WITH PHOTOELECTRIC DISTANCE SENSORS

While automating manual processes for manufacturers struggling with large staff shortages, engineers at Biuro Inżynierskie IEC set out to automate the insertion of chocolate bars into a flow pack machine. Determined to improve this process, they developed a system utilizing two cobots. However, the Biuro Inżynierskie team quickly realized a need for feedback. First, they needed to know how far into the box the robot should go to pick-up the bars. Second, they needed to know what level must be sensed to release bars into the magazine rails at the proper height. By utilizing IO-Link controls architecture and smart photoelectric distance sensors, they were able to implement this robotic automation application without costly additional input cards.

# Quality Assurance Case Studies

Identifying manufacturing and processing errors as early as possible is essential for high productivity. Continuous checks during the production or packaging process are critical to prevent lost batches and improve OEE. Continuous checks keep products that do not meet quality standards from making it as far as filling, packaging or shipping. Sub-par products, once identified, are then improved or discarded, avoiding a possible recall. With the goal to reliably monitor your products and processes, there are a wide variety of technologies available from sensors to machine vision to industrial RFID systems that ensure continuous traceability throughout the process chain.

ERROR PROOFING OF BAG FILLING

PRO-ASSEM sp. Z o. O. is regularly asked by customers about automating quality control measures. Manual inspection is time consuming and operators can fail to detect defects in the product, possibly allowing defective product to reach the end customer. In this application, the machine needed to use 50% fewer operators and be 50% faster while having 100% control over the quality of the finished product: a foil bag filled with a liquid and cut to size. By utilizing a combination of photoelectric sensors, and magnetic field sensors on the pneumatic actuators, the design specifications were achieved, saving the customer time in inspections and increasing the machine's efficiency.

FORMAT CHANGE & TRACEABILITY WITH RFID

The quality requirements of the world's premium chocolate manufacturers include not only the raw materials and packaging, but they extend to the production process itself. LoeschPack sought a method to reduce the time spent performing changeovers and increase the flexibility of the format change process. They wanted to ensure that the packaging machine would only power on when all the right components are in the right place for the set recipe. To do this, UHF (ultra-high frequency) RFID technology is used to read the presence of all change parts at once. This makes it easier to prevent mistakes because the differences are often small and difficult to see with the naked eye. In addition to identification of the parts for format change, other data is stored on the RFID tag such as service life, maintenance records, last operator, and previous cleaning cycle.

**Boosting efficiencies**

# TECHNICAL CONSIDERATIONS

B *innovating automation*

When designing an automation application for packaging, food and beverage applications, some key technology considerations must be taken into account during the sensor and device selection process. An understanding of the open standard IO-Link and machine vision technologies are foundational to technical success. Additional concepts like industrial RFID, condition monitoring and machine safety all play an important role. Due to the special nature of food and beverage production, we offer some considerations for how to address the mix of automation and food safety for the best application outcomes.

- What is IO-Link?
- Industrial RFID
- Condition monitoring
- Smart Automation and Monitoring System

# WHAT IS IO-LINK?

Utilizing a widely accepted and open vendor neutral technology for point-to-point communication, IO-Link offers an architecture that is fieldbus independent. Process data shows up as simple packets of bytes in the controller for easy integration. The parameterization data allows the devices to be quickly configured using simple read/write commands, and best of all, there is no "sub-bus" to cause headaches, nor is there a new protocol to learn.

## CAN I GET THAT SENSOR WITH ETHERNET?

There is a technology that allows for multiple intelligent field devices to be installed on the industrial Ethernet network without costly overhead. This technology is called IO-Link. With IO-Link you will use the existing equipment infrastructure to connect multiple intelligent devices to one IP address through a master/device relationship.
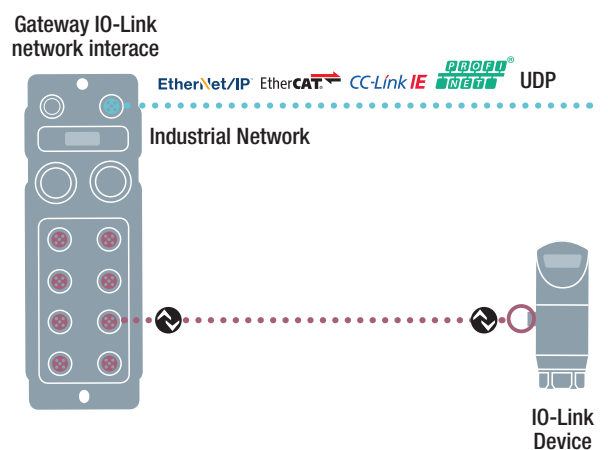
### Features

- Universal – Open vendor neutral standard (IEC 61131-9) that works with existing industrial protocols
- Smart – Flexibility and visibility down to the individual sensor with diagnostics and parameterization
- Easy – Simple maintenance and quick setup of new devices

## USE YOUR EXISTING NETWORK ARCHITECTURE

IO-Link technology utilizes your existing network Infrastructure. Addressing is point-to-point with a master/device relationship.

### Features

- Universal, similar to USB architectures
- Typically one device per master port
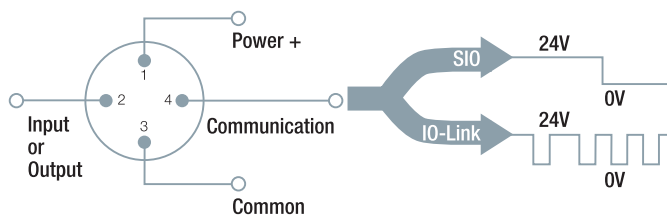- All major PLCs and industrial networks supported





**Gateway IO-Link network interace**

EtherNet/IP  EtherCAT  CC-Link IE  PROFINET  UDP

**Industrial Network**

**IO-Link Device**

M12 3-WIRE CONNECTION – POWER & COMMUNICATION

The digital signal is carried over pin 4 of a standard sensor cable
and 24V power is provided to the device in a standard configuration. If required, the IO-Link port can be used for a standard I/O point.

Features

- High noise immunity due to the 24V-step serial signal
- Utilizes low cost unshielded 4-wire standard sensor cables
- Cable runs can be as long as 20 m

FOUR OPTIONS FOR SETTING THE PARAMETERS OF AN IO-LINK DEVICE:

### Option 1 – Controller Parameter Storage
- Store in a data-table in the controller
- Push by the controller to the device
- Store multiple configurations

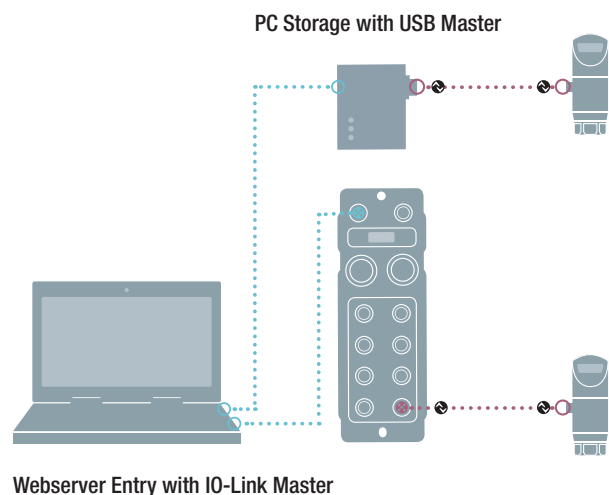### Option 2 – IO-Link Master Parameter Server
- Activate built-in parameter storage
- Store most recent parameters in the master
- Download automatically upon replacement

### Option 3 – PC Storage with USB Master
- Store on a computer or IT network
- Connect via USB to the device
- Download parameters manually

### Option 4 – Webserver Entry with IO-Link Master
- Store as a list in a document or file
- Connect via the webserver to the device
- Upload parameters manually

PC Storage with USB Master
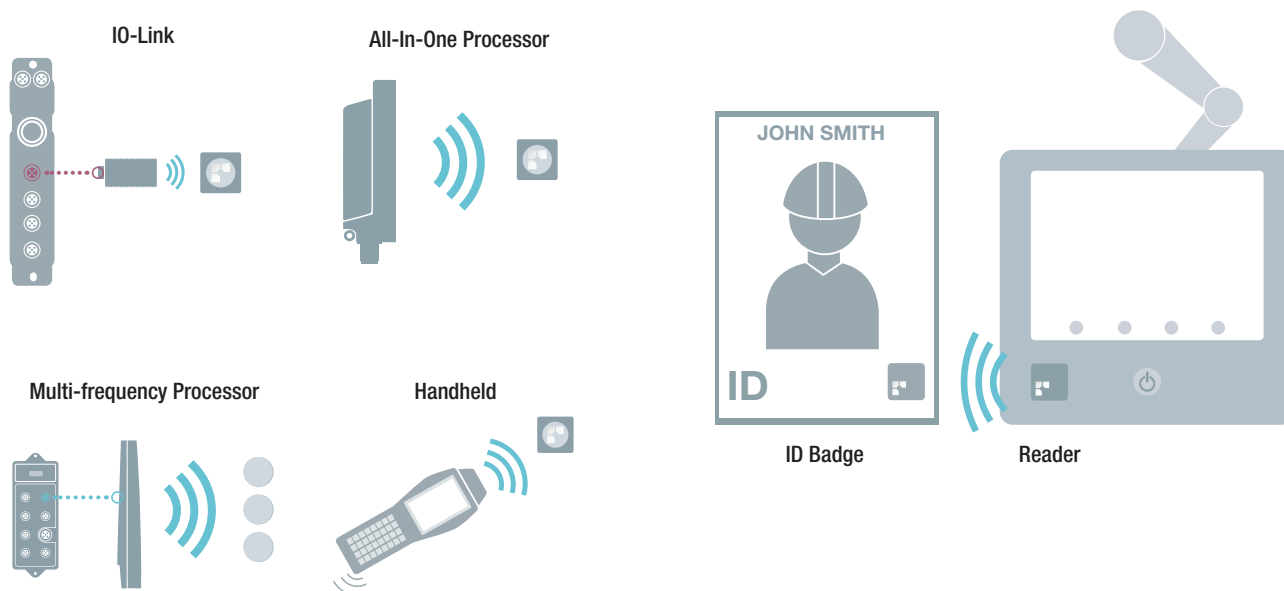
Webserver Entry with IO-Link Master

# INDUSTRIAL RFID

For more than 30 years Balluff RFID systems have provided customers around the globe with actionable data. In turn, these organizations were equipped with reliable information to make complex business decisions. Balluff RFID systems are designed for some of the toughest environments and can connect to nearly any control network. With industrial RFID you can trace all processes in a production environment from raw material procurement to production to consumption and disposal. This brings transparency to the production sequence, its framework, and the use of the raw materials. By implementing Industrial RFID manufacturers improve machine throughput, increase visibility and control quality to improve OEE in the plant.

## MULTIPLE ARCHITECTURE OPTIONS

Every RFID system requires three parts — a processor, an antenna (head) and a data-carrier (tag). The specific technologies required for each application are based on multiple factors: available physical space, PLC specifications, washdown/chemical ratings, read/write distance, information storage location, and the ability to tag the asset to be traced. IO-Link head/processors are commonly used in food and beverage applications as they can combine into one network connection. Other applications require more data, and a processor/head that sits right on the industrial network is preferred. In the most complex applications, separate heads and processors are utilized to guarantee application reliability and efficiency. In all applications, handhelds are used by technicians to track maintenance and support calls. Thousands of tag options are available, and different combinations of frequencies and controls architecture can be utilized to create the best application to improve machine changeover time or provide detailed lineage/authenticity data.

## MACHINE ACCESS CONTROL

Industrial RFID systems provide a controlled and tamper resistant solution for limiting access to the machine. Using RFID to differentiate between operators, technicians, supervisors and engineers can restrict access to certain maintenance screens or automatically change the views for the HMI or interface. Access control is used for verifying the operator's work times, tracking regular maintenance or supervisor override status. Many current solutions utilize physical keys for supervisor override or maintenance calls, but keys are easily copied, lost or shared by employees on the floor causing issues and confusion.

IO-Link

All-In-One Processor

Multi-frequency Processor
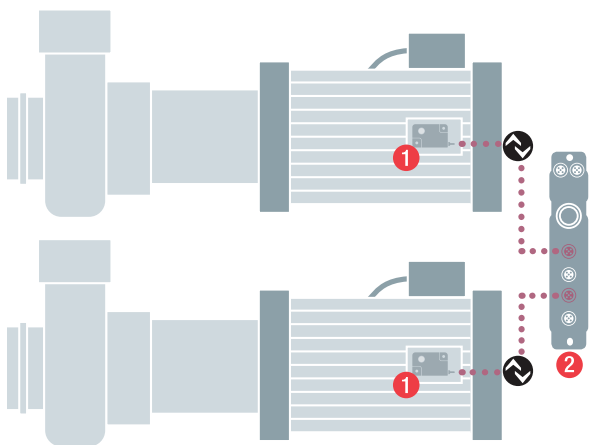
Handheld

JOHN SMITH

ID

ID Badge

Reader

# CONDITION MONITORING

You are only as strong as your weakest link. By utilizing condition monitoring, you can monitor the status and health of components and auxiliary units like bearings, linear drives, fans, compressors, HVAC units, chillers, belts, remote pumps and electrical cabinets. These devices have many places for potential failure: wear, friction, unbalance, particle accumulation, heat, humidity, displacement or collisions. With condition monitoring technology, the health of your plant, machine or component can be understood. Improvements to production output, equipment OEE, and predictive maintenance can all be realized by utilizing condition monitoring where critical components provide clues before failure.
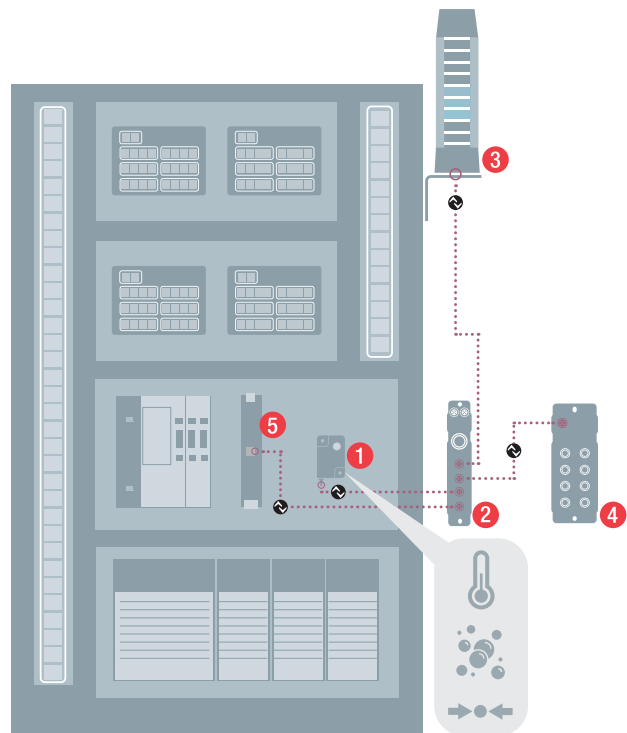
## FOOD AND BEVERAGE PUMP MONITORING

Pumps are used to transport unpackaged product from one part of the plant to another, for example from storage tanks to mixing processes to the filling or bottling machines. Hundreds of pumps are used in a typical food and beverage factory and are commonly critical to hitting output goals and maintaining plantwide OEE objectives. By monitoring the vibration and temperature condition of the motor and pump, you can better understand the health of the impelle, monitor the presence of lubricant, or detect changes in the system before catastrophic failures or downtime can occur. We can best understand the status of this equipment when combined with flow monitoring systems like pressure sensors.

## CONDITION IN THE CONTROLS CABINET

Ambient monitoring inside the controls cabinet gives an overall assessment of the health of the controls cabinet and the environment the sensitive control components might be exposed to. High temperatures prematurely age electronic components, shortening the lives of devices like power supplies or drives and causing downtime from electronic failures. At low humidity levels, electrostatic discharge (ESD) is easily generated causing intermittent interferences or malfunction in production processes. At high humidity levels, possible condensation occurs causing corrosion, rusting, or shorting of IP20 unprotected electronic devices, making it frustrating to troubleshoot intermittent issues. Monitoring the condition inside the controls cabinet for these conditions allows for corrective actions to be made before damage occurs.

| # | | # | |
|---|---|---|---|
| 1 | BCM Condition monitoring sensor | 3 | BNI SmartLight indicator |
| 2 | BNI IO-Link network interface | 4 | BNI IO-Link I/O hub |
| | | 5 | BAE PS Heartbeat power supply |

# SMART AUTOMATION AND MONITORING SYSTEM (SAMS)

Increasing the efficiency of machines and equipment requires high-performance, multi-functional solutions that provide not only machine control but also data about machine condition. This information lets you optimize the performance of every machine and, thereby, optimize the entire plant, so you can design processes and sequences efficiently and flexibly. Using the Smart Automation and Monitoring System (SAMS) from Balluff lets you manage the automation of your entire production line uniformly. Among other usage possibilities, this is especially interesting for the machine builder tasked with equipping the food and beverage, pharmaceuticals and cosmetics, and the packaging industries.

## SMART FEATURES

Once placed in service, the devices are turned into data sources. You can monitor and measure temperature, relative humidity, inclination, vibration, signal quality, operating hours counters and time functions. This data eliminates the need for additional devices with a monitoring function.

## DEVICE HEALTH AND STATUS

Status messages let you quickly detect and localize errors (condition monitoring). This information is always available to you – whether via the colored LED indicator directly on the device or on dashboards for further analysis (predictive maintenance).

WASHDOWN PLUS PROMISE

All the washdown components that are part of SAMS are designed to withstand the tough demands of cleaning processes. They meet Ecolab requirements, and with a rating of at least 1000 cleaning cycles, they far exceed the requirements for IP69K.

FOOD SAFETY

SAMS offers you outstanding solutions for the hygienic zone. Contamination resistant surfaces and materials meet all the hygiene standards for use in the food contact zone.

LOOK AND FEEL

SAMS increases machine flexibility and availability. Using standard data profiles for parameterizing, configuring and even non-contact teaching with a mobile terminal device reduces machine damage and production stoppages.
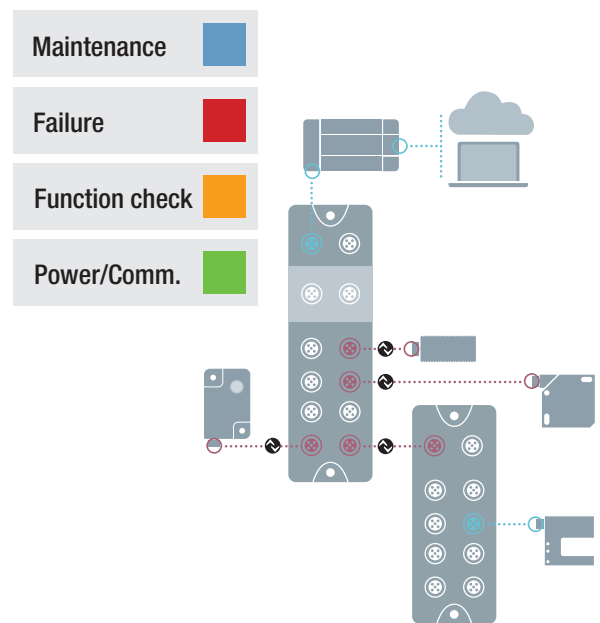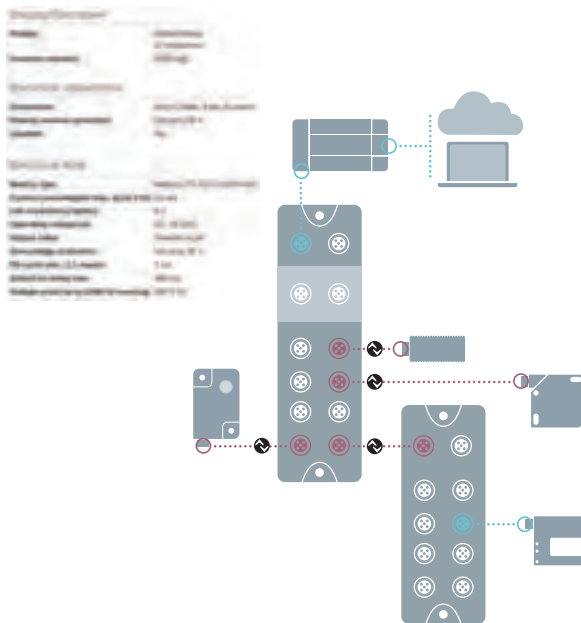
# SMART AUTOMATION AND MONITORING SYSTEM (SAMS)

## LOOK AND FEEL

The all-encompassing operating and configuration concept of SAMS increases machine flexibility and availability. The devices can be parameterized, configured and even taught without contact from a tablet using standard data profiles. This reduces machine damage and production stoppages due to incorrect handling to a minimum. Even relatively untrained personnel quickly find their routine using our consistently operable solutions and can avoid errors.
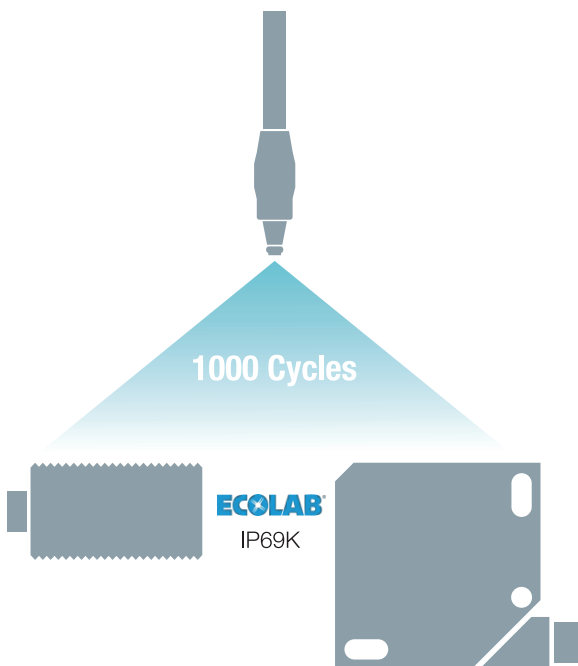
## DEVICE HEALTH AND STATUS

You always have an overview of machine and equipment health, since condition messages allow errors to be quickly detected and localized (i.e. condition monitoring). This information is always available to you uniformly, and directly – whether via the colored LED indicator directly on the device or on dashboards for further analysis (i.e. predictive maintenance). You can visualize this information as graphics, represent it in charts, or output it as reports. Now that you are informed about each individual sensor, every machine and your entire production, you can recognize trends and plan replacement or optimal maintenance for just the right time. Together with our powerful network technology and cloud computing, this data makes intelligent manufacturing and the Industrial Internet of Things (IIoT) become reality. To this end an edge gateway and IT level can be seamlessly linked.

| | |
|---|---|
| **Maintenance** | |
| **Failure** | |
| **Function check** | |
| **Power/Comm.** | |

WASHDOWN PLUS PROMISE

Significantly longer service life and significant cost savings due to less maintenance are what you can expect from all washdown components in the Smart Automation and Monitoring Systems. They are designed and manufactured specially to withstand the high demands of cleaning processes. At home in extremely harsh environments, they meet Ecolab requirements. They are well protected from cleaning agents and water, and with a rating of at least 1000 cleaning cycles, our products far exceed the requirements for IP69K.

FOOD SAFETY

Thanks to contamination resistant surfaces and materials these hygienic components meet all the hygiene standards for use in the food contact zone. Our products meet the provisions of Good Manufacturing Practice, so that you too are easily able to implement a GMP conformal quality management system including documentation. Use of data matrix code means the raw materials used in each product are traceable at any time. This is essential for ensuring the highest product quality as well as for meeting all the requirements of the health authorities (EU Regulation 1935/2004/EC).

BCS CAPACITIVE HYBRID SENSOR

BTL SF HYGIENIC LINEAR POSITION SENSOR

BCC IP69K WASHDOWN RATED CABLES AND CONNECTORS

BNI STAINLESS IP69K I/O BLOCKS AND IO-LINK NETWORK INTERFACES
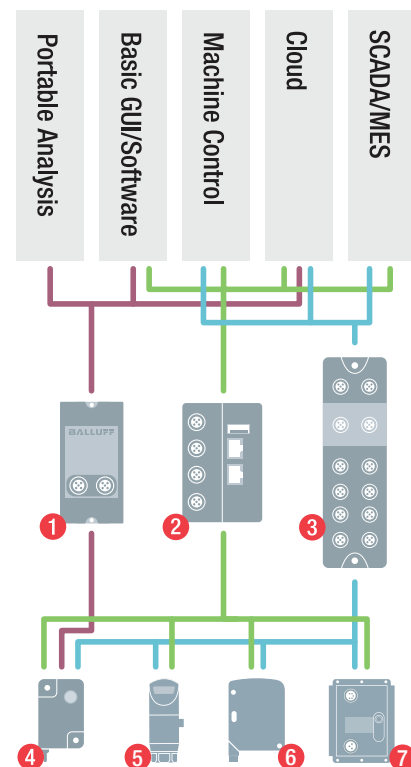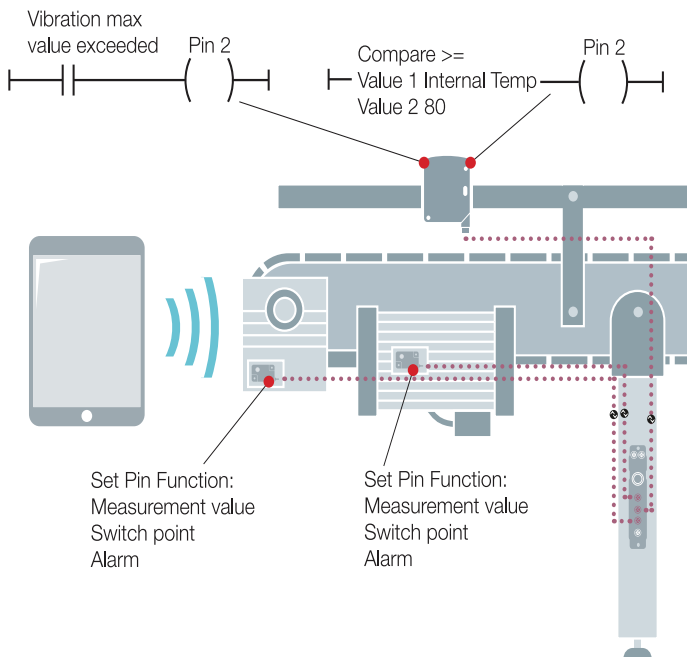
1000 Cycles

ECOLAB
IP69K

# SMART AUTOMATION AND MONITORING SYSTEM (SAMS)

## SMART FEATURES AND DISTRIBUTED LOGIC

With their consistent design the housing, connector and fastening of the components form a unit, so that installation and connection are easily accomplished. Additional functions such as temperature monitoring, inclination detection, vibration monitoring, signal quality display and/or operating hours counter turn devices into data sources you can use for reliable operation of your equipment. Such features eliminate the need for additional devices with a monitoring function, significantly reducing your inventory levels. In addition, each component can be uniquely located within the system by pinging.

## DATA ACQUISITION AND SOFTWARE

The future of automation is increasingly interlinked and digital. The growing diversity of technology, including in the private sector, means the expectations of many users are increasing while the demands on industry rise. Meeting these increasing demands necessitates the merging of traditional automation technology (OT) and information technology (IT). The increased use of software is the next logical step. We offer you IIoT capable hardware and middleware in combination with powerful software. This means you benefit from system solutions for the widest variety of requirements in your production environment. You get solutions for condition monitoring of your machines, for monitoring your production equipment or systems for format change management.

**1**    Portable Monitoring System
**2**    Condition Monitoring Toolkit
**3**    Network interface with JSON or REST api
**4**    Condition monitoring sensor
**5**    Smart IO-Link sensors
**6**    SAMS with condition monitoring
**7**    Heartbeat power supplies

# WEBSHOP AND ACCOUNT PORTAL

## Easy online shopping
### Navigate through the collections or run a search

In addition to attractive, transparent pricing, Balluff's webshop gives you the product information you need to work quickly and efficiently. You can access our entire product range in just a few clicks.

- **See real-time availability**
  See which parts are in stock and available for shipment the next business day by adding them to the cart.
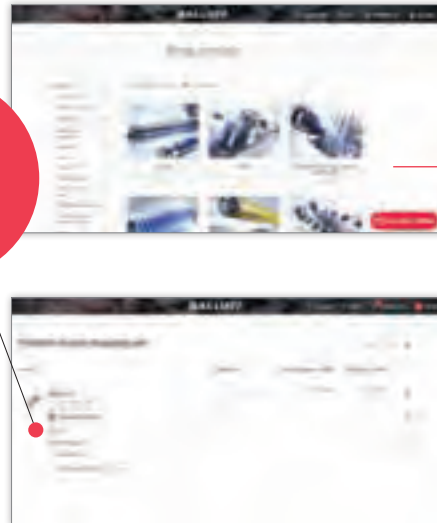
- **Find relevant order information**
  You can look up material numbers and receive information on a product's country of origin, weight and customs tariff number with your account.

- **Attractive prices**
  Find low-cost solutions for all your application needs. Special prices for existing customers are shown in the shopping cart.

- **Low shipping fees**

**CHECK STOCK**

The My Balluff page gives you central access to your customer account.

New features also simplify your ordering process.

- **View order history**
  Now use the order history to view your current and past orders.

- **Download receipts**
  Download quotes, invoices and delivery receipts at any time.

- **Track orders**
  Track your delivery and get information about the current delivery date.

- **View and confirm quotes**
  Confirm individual quotes online. After you confirm the quote, we will process the order.

- **Log in now: my.balluff.com**

**DOWN-LOAD RECEIPTS**

Invoices and delivery notes

**TRACK ORDERS**

Order Tracking

# GLOSSARY

**Controls architecture**

An application area focused on the physical architecture of inputs and outputs. Controls architecture also focuses on improving how different data is communicated to the control as well as the plant monitoring services. This is done through improvements in the machine connectivity by the use of machine mount hardware and smart devices.

**Food safety**

Food safety is an objective to keep food safe for consumption without biological or material contaminants. This is important for automation considerations due to a need for food contact of some components. Hygienic sanitary machine design and hygenic component design have an impact on automation product selection and design.

**Format change**

In this application area, there is a focus on how to use technology to improve format changes through decreases in changeover time or reduction of errors. Size change, changeover, recipe change are all impacted by this. Manual format change uses rules or marks, guided format change helps the operator with automation to setup properly and automatic format change can eliminate human error entirely.

**Level sensing**

By engaging with this application area, production processes dramatically eliminate errors. Level sensing uses sensors to provide point-level indication of full or empty or uses sensors to provide continuous level feedback to know the exact amount remaining in a tank or container.

**OEE**

Overall equipment effectiveness (OEE) is a common measure of a production plant's or production line's or a machine's output. Through a combination of improving availability, enhancing quality and expanding performance, OEE can be dramatically improved with innovative automation technologies reducing waste and improving yields.

**Predictive maintenance**

The application area of predicitive maintenance utilizes smart factory principles and condition monitoring tools to receive diagnostic/event data from devices and trend that data over time with the objective to predict when maintenance activities should occur and eliminate unplanned downtime. In contrast to preventative maintenance which is periodic, predictive maintenance monitoring is typically continuous.

**Preventative maintenance**

The regular and routine maintenance of equipment and assets in order to keep them running and prevent unplanned downtime from unexpected equipment failure.

| | |
|---|---|
| **Quality assurance** | As an overall plant strategy, quality assurance teams track conformance to standards, legal requirements, record keeping and monitor product quality. Automation is used to identify and contain deviations while maintaining uptime and preventing recalls. Error-proofing or inspections are used to monitor the product quality while traceability solutions are used to track-and-trace in production material flow and work in process (WIP) tracking. |
| **Retrofit** | A machine retrofit typically utilizes existing mechanical equipment and updates the controls or adds functionality to the machine. The ultimate objective of the retrofit is to improve the overall effectiveness of the machine without entirely replacing or scrapping it. |
| **RFID gateway** | A high-frequency RFID communication module used for point-to-point connection or as a bus interference. |
| **Robotics automation** | Robots are a quickly growing investment in food and beverage plants. This application area focuses on how secondary automation tools, sensors and I/O devices can dramatically improve the utilization of robots improving the project return on investment (ROI). |
| **SCADA** | Supervisory control and data acquisition (SCADA) is a system of software and hardware elements that allows industrial organizations control industrial processes locally or at remote locations. |
| **Smart factory** | Industry 4.0, Industrial Internet of Things (IIoT) and Smart Factory are regularly used interchangeably to indicate plant projects working toward improving efficiency, adding flexibility and raising visibility inside a plant with the end objective to increase OEE. IO-Link and smart sensors support this objective by enabling manufacturers with actionable data and information for their smart factory projects. |
| **Types of data** | There are many types of data. In this guide we discuss 3 major types of data generated by IO-Link devices: diagnostic/events data, parameter data and process data. Process data is the cyclic data used by the PLC to run the machine. Parameter data is the configuration setup of the device. Diagnostic or events data are generated to provide warnings or clues for predictive maintenance activities and expedite troubleshooting. |
| **Washdown Plus** | A Balluff standard that exceeds Ecolab and IP69K requirements. Products with the Washdown Plus Promise are tested to withstand at least 1000 cleaning cycles providing significantly longer service life and less maintenance and expense than traditional sensors. |

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