Smart Sensors with ⌾ **IO**-Link

Enabling Smart Machines for The Connected Enterprise

A·B *Allen-Bradley*

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THINK.
SOLVE.®

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Rockwell Automation

Visibility from Plant Floor to Front Office

The Connected Enterprise is reshaping industrial automation by converging information technology (IT) and operations technology (OT) into a single, unified architecture. Enabled by integrated control and information and enhanced by the Internet of Things (IoT), the Connected Enterprise allows us to gather and analyze data, transforming it into actionable information. Our Integrated Architecture® helps manufacturers create intelligent equipment that provides access to that information and enables agile reaction to changing market demands. And Allen-Bradley smart sensors and I/O – based on IO-Link technology – are the foundation of integrated control and information, providing seamless visibility of field data through your Integrated Architecture control system.

Enabling The Connected Enterprise with Integrated Control and Information

Enterprise Optimization	**Business Management**
Information Aggregation and Analytics	**Production Management**
Converged, Secure Network Infrastructure	**Operations**
Multi-disciplined Control	**Engineering**
Intelligent Assets	**Maintenance**

What is IO-Link?

IO-Link is a worldwide open-standard peer-to-peer serial communication protocol (IEC 61131-9) that allows sensors and actuators to easily integrate into The Connected Enterprise. Through IO-Link you can access all sensor configuration parameters, process data and diagnostics. You can go beyond detecting products on your machine – now you can MONITOR your machine's health as it runs. Plus, IO-Link simplifies setup and commissioning while offering enhanced flexibility for your current – and future – processes.

By combining simple implementation with powerful data and diagnostics, smart sensors with IO–Link can optimize your machines today – and prepare them for the future – to increase your uptime and productivity.

Faster Time to Market

- Program sensors and the controller in the same software environment (Studio 5000® software)
- Intuitive programming simplifies initial setup and helps eliminate logic errors
- Seamless integration with the Rockwell Automation Integrated Architecture

Lower Total Cost of Ownership

- No incremental cost for IO-Link enabled sensors
- No wiring changes
- Scalable solution – enable IO-Link functionality as needed
- Fully-configurable sensors reduce your device inventory and streamline SKUs by 50%

Improved Asset Utilization

- Easy access to actionable, contextualized data that can help you maximize Overall Equipment Effectiveness (OEE) and Mean Time Between Failures (MTBF)
- Real-time diagnostics including timestamp functionality optimize preventive maintenance and troubleshooting, reducing issue resolution time by up to 90%
- Multiple profiles facilitate flexible manufacturing by reducing changeover time for each sensor from minutes to seconds

Enterprise Risk Management

- Automatic Device Configuration (ADC) capabilities reduce errors upon sensor replacement
- Restrict configuration changes to authorized personnel only
- Ensure BOM compliance

Smart Sensors. Smart Machines. Smart Manufacturing.

Our Integrated Smart Sensor Solution

A truly connected enterprise has real-time control and information available across platforms and devices within the organization. When it comes to linking end point devices on the plant floor to The Connected Enterprise, our Integrated Architecture leverages smart sensors and I/O to deliver information, advanced functionality and flexibility, increasing efficiency machine- and plant-wide.

In-Cabinet

EtherNet/IP

EtherNet/IP

On-Machine
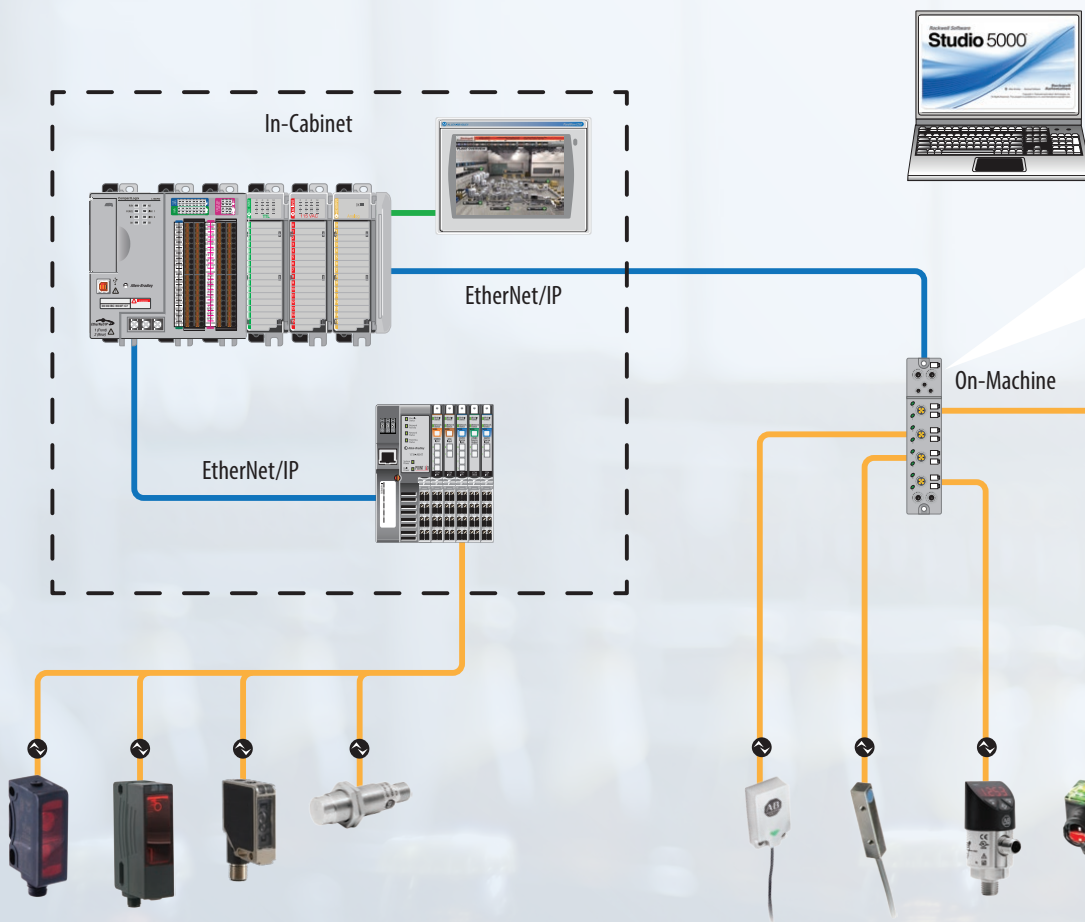
When using the full Rockwell Automation solution including Studio 5000 Logix Designer™ software, you get Premier Integration – an enhanced level of integration plus features and functionality not available with competitive offerings, such as:

- Simplified sensor configuration through Add-On Profiles (AOP)
- Controller saves sensor configuration automatically for device replacement conditions (ADC)
- Automatically formatted and named sensor tags

Allen-Bradley IO-Link Enabled Products

1734 POINT I/O™ and 1732 ArmorBlock IO-Link Masters

IO-Link Masters

- Enable connection of up to eight devices (IO-Link enabled or standard I/O)
- POINT I/O™ master for in-cabinet (IP20)
- ArmorBlock™ version for on-machine (IP67) applications
- Timestamp functionality in ArmorBlock model provides visibility to sensor data for better quality metrics

42JT VisiSight™ Sensor

42EF RightSight™ Sensor

45LMS Laser Measurement Sensor

45CRM Color Registration Mark Sensor

Photoelectric Sensors

- Notifies system when lens is dirty
- Parameter changes supported through controller during line/tool changes for flexible manufacturing (e.g. set points)
- Indication of sensor signal strength for monitoring machine wear and tear
- Locking options are available to lock local settings when operating in IO-Link mode, and therefore any user changes will not change the settings of the sensor.

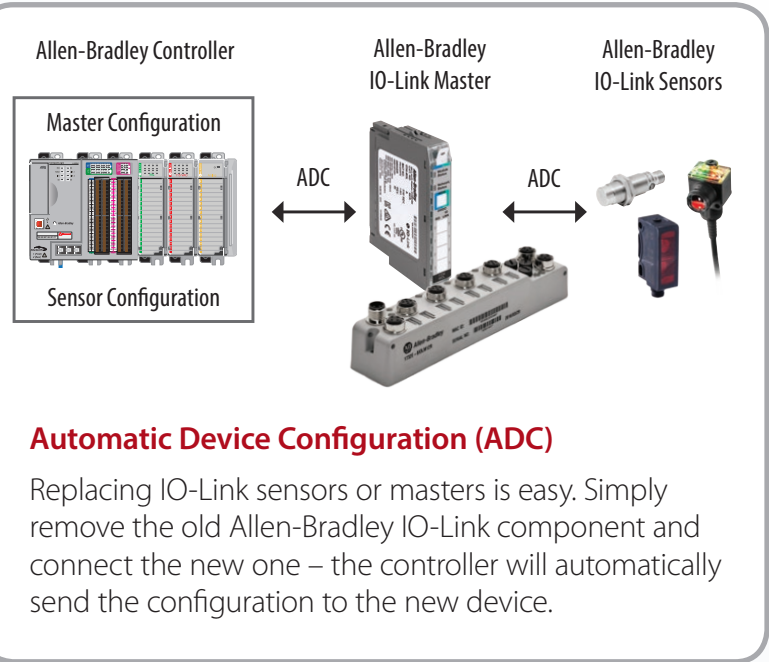| Timestamp Example			Date	Hr	Min	Sec
Conv 1	Sensor 1	Low Margin (lens dirty)	7/21/16	03	27	12
Conv 1	Sensor 1	Good Margin (lens clean)	7/21/16	04	05	35
Conv 1	Sensor 2	Temperature Overrun	7/22/16	11	55	22
Conv 2	Sensor 3	Disconnected	7/23/16	12	12	27
Conv 2	Sensor 3	Reconnected	7/23/16	12	14	55
Conv 1	Sensor 2	Parameter Change	7/24/16	10	53	39

Timestamp data (CIP Sync) pinpoints sensor events and input data for real-time monitoring of:
- Sensor/cable damage or replacement
- Sensor parameter changes
- Target presence or absence
- Lens dirty/clean

Profile 1: 1,000
Profile 2: 2,000
Profile 3: 12,000
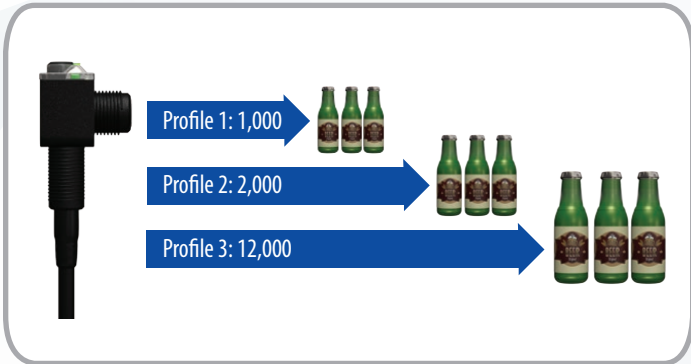
Multiple profiles can be set up and stored to support flexible manufacturing
- Make sensor parameter changes in seconds (e.g. for different package sizes)
- Eliminate manual teach errors during changeovers
- Consistent parameter values sent to sensor for line changes
- Personnel no longer need to remember multiple sensor teach processes

Allen-Bradley Controller
Master Configuration
Sensor Configuration

Allen-Bradley IO-Link Master

Allen-Bradley IO-Link Sensors

ADC   ADC

Automatic Device Configuration (ADC)

Replacing IO-Link sensors or masters is easy. Simply remove the old Allen-Bradley IO-Link component and connect the new one – the controller will automatically send the configuration to the new device.

871TM
871FM
871C Miniature
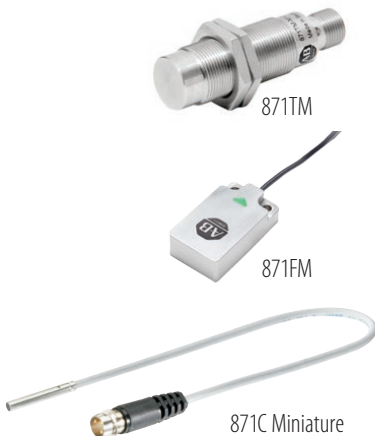
Proximity Sensors
- Margin status helps optimize sensor installation for best performance
- Monitor the distance to detected targets (detect machine wear and tear)
- Immediate indication of damaged sensing element
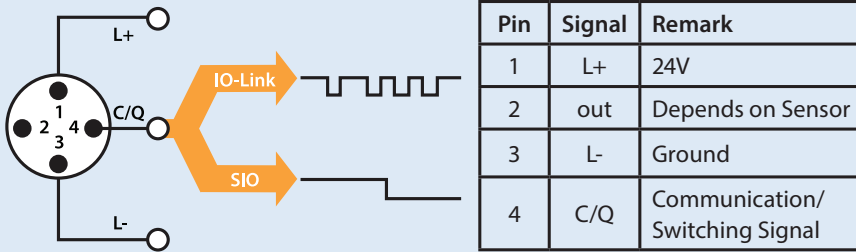- Application-specific names help the user quickly locate the sensor on the machine.

837T
836P

Pressure and Temperature Sensors
- Actual Pressure and Temperature values available at the controller
- Change set points via controller when process changes are needed
- Use controller to adjust parameters and use local display for current values
- Configure sensor data units (i.e. PSI or bar for pressure sensors)

How Does ◈ **IO**-Link Work?

Smart sensors featuring embedded IO-Link act the same as the standard I/O sensors you're already using until connected to a master. But by interfacing these sensors with an IO-Link master, you can access all the advanced data and configuration capabilities IO-Link has to offer. This means you have the flexibility to install smart sensors as standard I/O today and activate IO-Link functionality later – whenever and wherever you want it – without having to install costly new wiring or sensors.
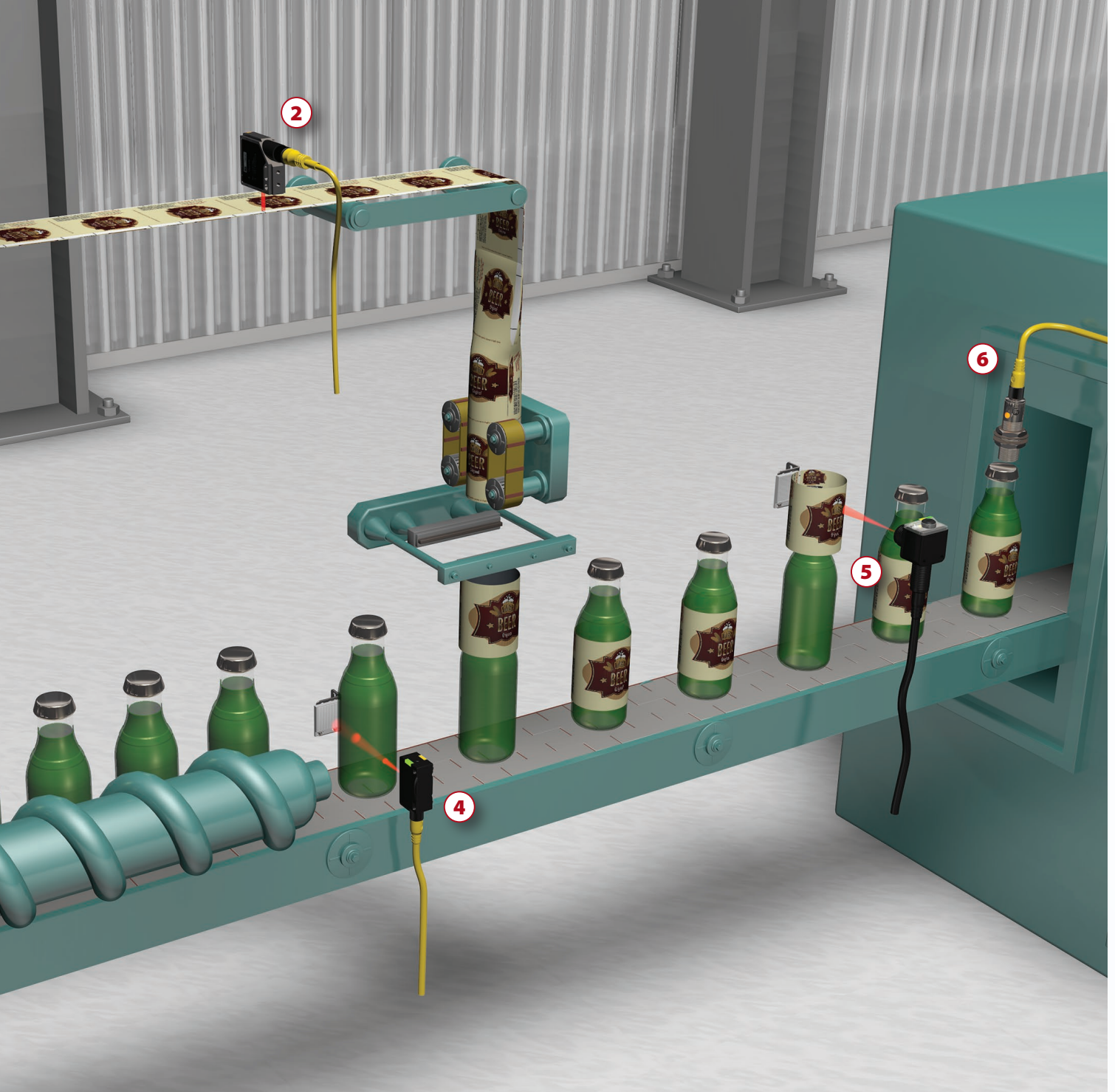
Pin	Signal	Remark
1	L+	24V
2	out	Depends on Sensor
3	L-	Ground
4	C/Q	Communication/Switching Signal

Applying ◈ **IO**-Link

This example illustrates how IO-Link can change how you perceive and maintain your machine. Instead of using sensors to count/detect product, they can also provide valuable machine health information to prevent downtime while improving process efficiency.

Note: This example highlights only a few key functions and not all of those offered by IO-Link and the enabled sensors.

Product	Function	Key IO-Link Function
① **45LMS – Laser Measurement Sensor**	Monitors label roll diameter	*Multiple Profiles*
② **45CRM – Color Registration Mark Sensor**	Detects label web registration marks	
③ **42JT – Photoelectric Sensor A**	Detects product leaving the accumulator	*Automatic Device Configuration (ADC)*
④ **42JT – Photoelectric Sensor B**	Detects product for label placement	
⑤ **42EF – Photoelectric Sensor**	Detects improperly placed label sleeves	*Low Margin Alarm with Timestamp*
⑥ **871TM – Inductive Proximity Sensor**	Monitors presence of the bottle cap	*Sensor Health*

How Performed	Application Specific Name	Tag Name in Controller (Automatically Generated)
Set up in controller to trigger on roll of film to indicate when a new roll is needed. Since the trigger is timestamped, the controller will know when the roll typically runs out and how long it takes the operator to replace.	Zone2, LMS1,RollSize	My_1734_4IOL:1:I.Ch0.Distance My_1734_4IOL:1:I.Ch0.Triggered1 My_1734_4IOL:1:I.Ch0.Triggered2 My_1734_4IOL:1:I.Ch0.MarginLevel
Message instructions can configure the sensor to detect new packaging during line changes	Zone3,CRM1,Register	My_1734_4IOL:1:I.Ch1.Triggered
If a sensor is replaced with another compatible sensor, the controller will send the "golden" configuration to the new sensor	Zone1,PE1,Bottle Detect1	My_1734_4IOL:1:I.Ch2.Triggered My_1734_4IOL:1:I.Ch2.MarginLowAlarm
	Zone1,PE2,BottleDetect2	My_1734_4IOL:1:I.Ch3.Triggered My_1734_4IOL:1:I.Ch3.MarginLowAlarm
Monitors sensor operating margin for diminishing performance due to a dirty lens. If the lens becomes dirty it will send timestamped notification to the controller that cleaning is recommended to assure target is detected. Also, the increase in margin after cleaning is timestamped, so the controller will know how long it took the operator to clean the sensor lens.	Zone2,PE2,LabelDetect	My_1734_4IOL:2:I.Ch0.Triggered My_1734_4IOL:2:I.Ch0.MarginLowAlarm
If sensor head is damaged, the controller receives a report that the sensor has failed and IO data is compromised	Zone4,PX1,CapDetect	My_1734_4IOL:2:I.Ch1.Triggered My_1734_4IOL:2:I.Ch1.MarginStatus

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The Connected Enterprise

Learn more about the Connected Enterprise transforms real-time data, from intelligent assets and multi-disciplined control from a plant, or a remote site into actionable information.
www.rockwellautomation.com/go/lit/ce

Product Selection Toolbox

Our powerful range of product selection and system configuration tools assist you in choosing and applying our products.
www.rockwellautomation.com/en/e-tools

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