

THE MANUFACTURER'S GUIDE TO FLEXIBLE, EASY, AND FAST INTEGRATION OF CONTINUOUS IMPROVEMENT

Enhance Your Existing Controls Infrastructure Investment with
IO-Link Technologies

White Paper

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Flexible, Easy, and Fast Integration of Continuous Improvement

For companies working with manual and semi-automated assembly processes, continuous improvement is a daily topic. Error-proofing, kaizan, poke-yoke, six-sigma, quality management, or quality assurance are a way of life when humans are involved in part of the assembly process. Your teams work hard to catch as many of these defects as possible before the mistake makes it to the customer or consumer. "Quality is our Culture" or "Continuous Improvement Conscious" are regularly seen in factories as not-so-subtle reminders to all of us that while perfection is impossible, the pursuit of perfection in our product is something we should live daily.

For those in management or engineering who are responsible for the quality of production in a factory, this can be a heavy burden. Regardless of how flexible we are in manufacturing, the more things we can automate in our processes will help reduce our errors and improve the end quality of our products. When looking for flexible automation equipment, there are always some base decisions that must be made:

- Will it work with what we have now? We can't rip out what we have working.
- How do we integrate the solution? We have limited time and resources.
- Can we also get it from a different supplier later if we have to replace it?
- Can we get it implemented ASAP? Like during a lunch break or scheduled shutdown?

Control architectures have significant impact on how a total error proofing program is implemented. Having a system that works well initially is somewhat easy. The real test is how well it works as time goes on. In an error proofing environment, easy expandability is a unique requirement. It is important to specify the appropriate control architecture during the initial design and build phase. This requires an architecture that easily integrates Poka-Yoke devices and traceability devices, such as Radio Frequency Identification (RFID), into one seamless system that allows easy and low cost expansion for the future. Expandable architecture built around the open standard of IO-Link seamlessly integrates Poka-Yoke devices and industrial identification devices. By keeping a few IO-Link ports open, future expansion is easy and cost effective. And the best part is the ability to implement the expandable architecture on popular control platforms from Allen-Bradley, Siemens, Mitsubishi and others.

These questions sometimes end up ruling out our first ideas and go-to solutions. However, IO-Link can easily meet these questions and challenges. IO-Link (www.io-link.com) is a vendor neutral, widely accepted technology that is regularly referenced as the USB for industrial automation. *Really, it works with what we have now and it can be integrated during a lunch break? I don't believe you.* IO-Link is the next generation of continuous improvement with flexible control architectures, easy fast integration, diverse inspection options, visibility and traceability.

IO-Link in 3 Words:

Universal.

Smart.

Easy.

The objective of this paper is not to make you an IO-Link expert. However, a few high level points must be addressed to see the full benefits of the technology.

Use YOUR network and control architecture

You can't rip out what you have now. IO-Link easily utilizes your existing industrial network infrastructure. The benefits can be seen regardless if you currently use industrial networks like EtherNet/IP or no networks with centralized PLCs. Addressing of the devices is point-to-point with a master/slave relationship as seen in Figure 1. Connectivity is made with low-cost unshielded standard 4-wire sensor cables up to 20 meters between the master and slave.

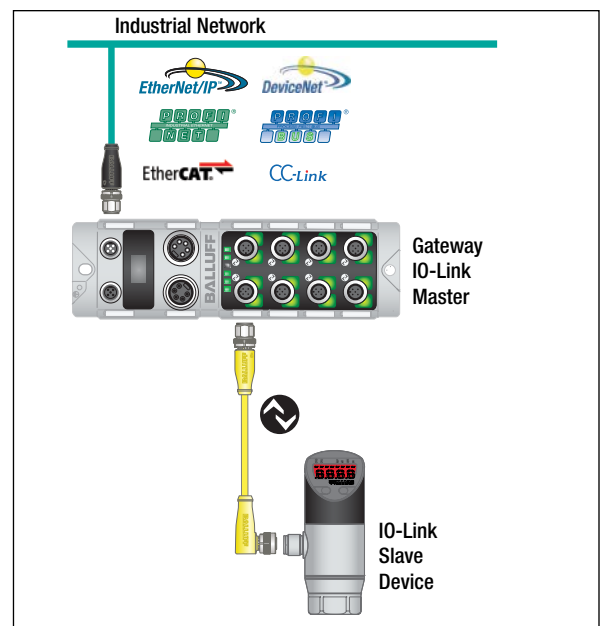


Figure 1: IO-Link architecture

Automate configuration and replacement

Smart field devices can require a higher degree of skill for technicians to be able to configure or replace. A typical error-proofing sensor usually has a measurement value or pre-programmed set points for tolerances. IO-Link devices are capable of being automatically configured on setup or replacement, eliminating manual programming of the error proofing device (Figure 2). If troubles occur, the sensor can report diagnostic issues like a dirty lens or more importantly could possibly report if the sensor has been bypassed or disconnected.

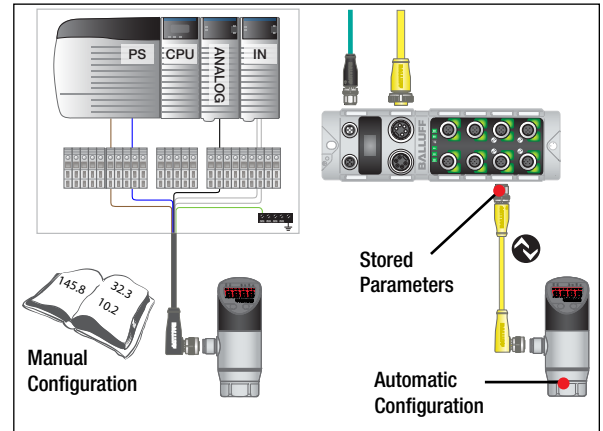


Figure 2: Manual vs automatic configuration

Choose what makes sense for your business

With a universal and open standard, products and technologies can be sourced from over 60 known vendors in the automation industry (Figure 3). This reduces your risk in selecting and implementing components because you keep control of with whom you do business. With over 24 IO-Link enabled technologies from electrical drives to proximity sensors and everything in between, the technology needed to implement error proofing is available today with IO-Link capabilities.

Define Your Continuous Improvement (CI) Implementation Plan

#1 Your CI Implementation Plan must be Flexible

Quality errors can come in a troubling variety. So the technologies utilized to detect these trouble spots tend to be various and assorted as well. Being able to flexibly implement the proper technology is vital to success. Think about these types of questions when defining your implementation process for flexibility:

- How many variants do we need to inspect?
- What technologies do we use to contain and identify nonconforming parts?
- How do we ensure rework was done properly?
- What technologies do we typically use to inspect part assemblies?
- Can we accommodate new discrete and analog inputs?

Flexible implementation architectures allow for multiple technologies to be selected, modified and adapted to changing requirements in the factory. The plug and play nature of IO-Link means that devices can be used in one application, modified for another application or moved to a better inspection location. The flexibility to plug any device, including standard discrete sensors, into an IO-Link master gives you virtually unlimited possibilities for control of your error proofing applications like color detection, analog I/O, and linear measurement with lasers, ultrasonic, position transducers (Figure 4).



Figure 3: IO-Link member companies

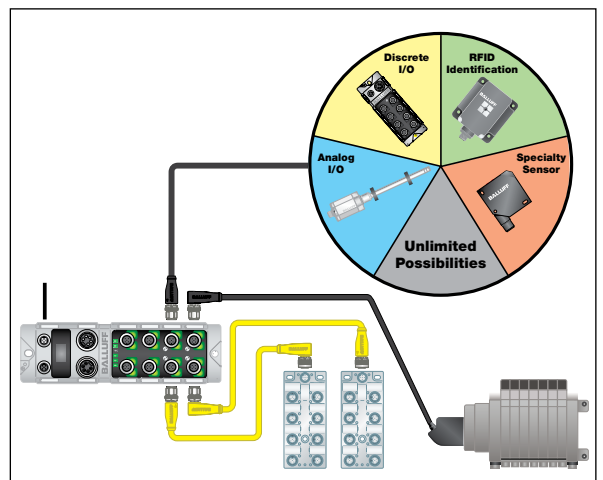


Figure 4: IO-Link provides wide flexibility

#2 Your CI Implementation Plan must be Easy to Use

If you want the team to live continuous improvement, it must be clear, simple and easy to implement. The harder we make it to do the right thing, the less likely we are to implement change. So selecting an Implementation plan that can be executed easily is a must.

- What does it take to setup a new inspection in production?
- How do we define the mistake or quality issue?
- How do we ensure that the issue does not appear again?
- How do we make sure the technology is implemented properly to ensure detection?

With IO-Link the ability to parameterize smart sensors and devices makes implementation and changes to inspections very easy. Some intelligent lasers and sensors can have more than a dozen programmable settings that must be accessed via a small, sometimes hard to see, push button interface. The engineer or technician has to spend a significant amount of time understanding how the product is configured properly. However, with IO-Link there are a variety of ways to configure a device and parameters can be stored for future or repeated use across similar installations. In addition, a large combination of parameters can be stored, uploaded and downloaded for use in the most flexible of production capabilities (Figure 5).

In the case of a device failing, a failure in quality could occur again due to a mistake in configuration of the replacement device. With IO-Link the ability to store parameters in the master and automatically configure the device means that once the configurations are determined, the quality inspection can be maintained (Figure 6).

#3 Your CI Implementation Plan must be Fast to Integrate

Selecting a technology that integrates into your existing controls system is a major requirement when trying to implement improvements on the fly. Quality errors and deviations must be identified, contained and rectified with minimal effect on delivery to the end customer or consumer.

When integrating smart sensors and industrial network ready technologies, the learning curve to implementation can be steep. Days or weeks of bench testing, software programming and trials can add costly delay to detection implementation. Control ready devices that provide software function blocks or Add-On-Instructions can dramatically reduce the complexity and time to integrate into the PLC (Figure 7).

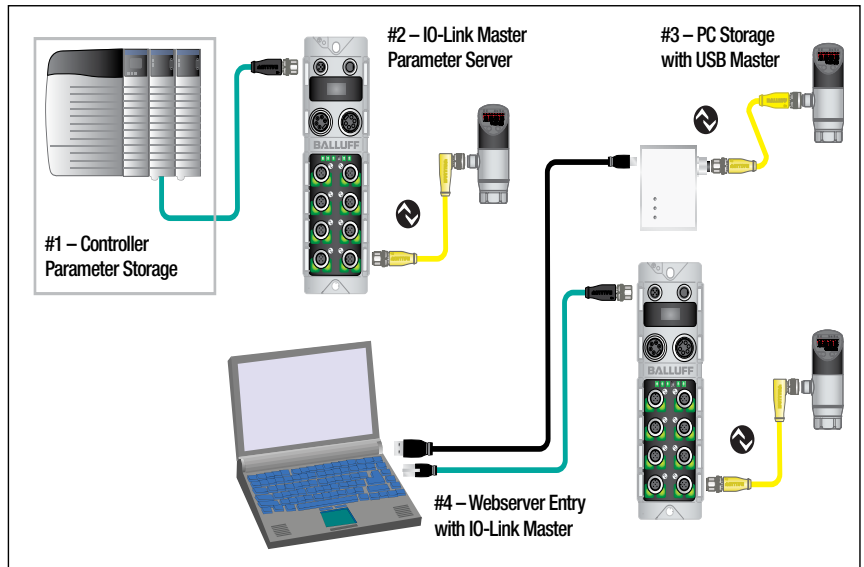


Figure 5: Multiple ways to parameterize

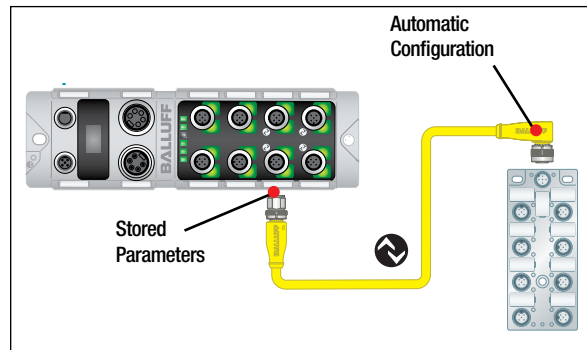


Figure 6: Hot swap failed devices

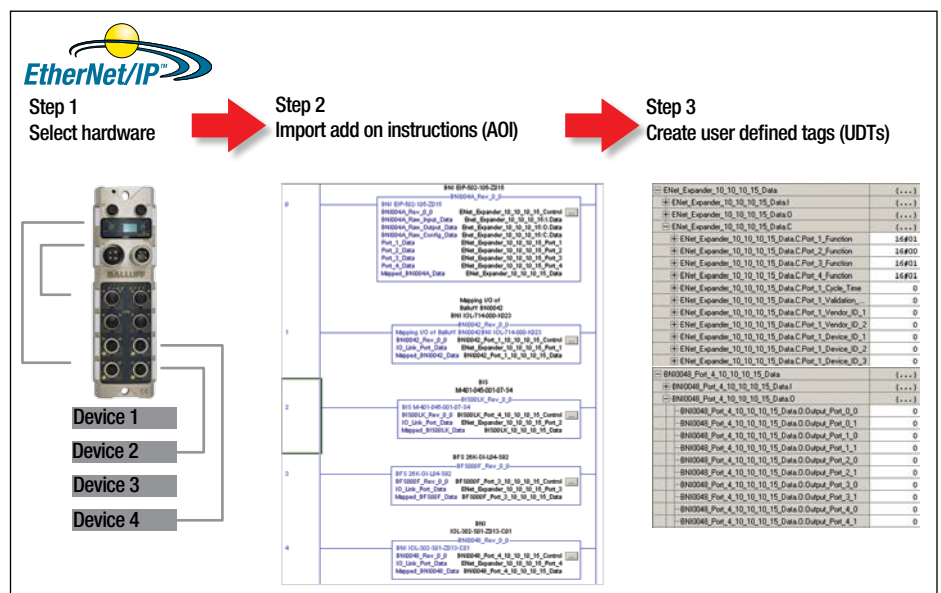


Figure 7: Ease of integration

While hardware selection is important to the success of a project, if the hardware is not easily integrated into the engineering software, any benefits gained could be lost. However, Distributed Modular I/O is easily integrated into the typical engineering software with an easy three step process. Below are examples of how to integrate industrial ethernet solutions. These steps can also be easily implemented on industrial bus networks.

In a typical measurement application the inspection device provides an analog output. The engineer then has to do multiple calculations based on resolutions and scaling to determine the actual engineering unit of measure such as psi or inches. Many IO-Link devices provide the pre-converted actual engineering units of the measurement they are providing. For example, in Figure 8, a laser sensor would provide the position value in mm in the process data to allow for easy integration. This eliminates any calculations required, reduces setup mistakes and gets the inspection operational faster.

Real World: Implementation Architecture in Action

By selecting IO-Link as the controls architecture in their facility, a Michigan based tier supplier is able to reliably implement on the fly improvements to their production equipment. Using Allen Bradley CompactLogix PLCs and the industrial Ethernet network, EtherNet/IP, they implemented a wide variety of technologies into their assembly processes; both before and after the initial machine build. Applications in use today include: discrete poke-yoke sensors looking to ensure components were in the proper place; (Figure 9) analog measurements inspecting component orientation; and smart sensors with diagnostics and automatic configuration (Figure 10).

Once they decided to have IO-Link as the architecture of choice, it was very easy for them to continuously make improvements. A process improvement engineer at this facility was tasked recently to determine the presence and orientation of a nut fed into a pedestal welder. His task was to make sure the nut was there as well as to ensure that the nut was not upside-down. He stated “With IO-Link, I was able to install the linear position transducer mechanically in the application, go into the code and have the entire project integrated in 20 minutes. I had planned a full day for implementing this application, but it was that easy (Figure 11).”

So by selecting IO-Link as their continuous improvement implementation plan they were able to integrate error-proofing solutions flexibly, easily and fast.

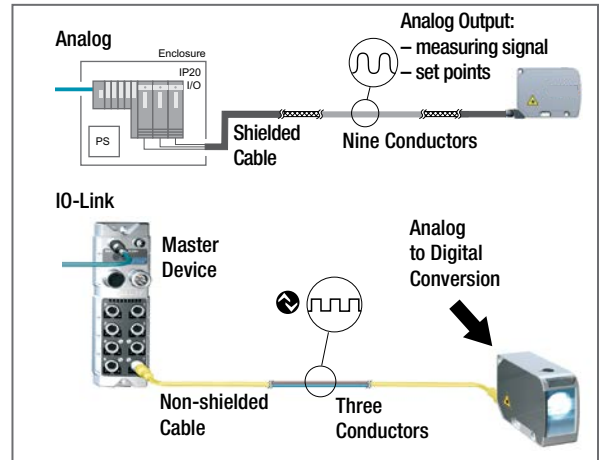


Figure 8: Measurement – Analog vs IO-Link

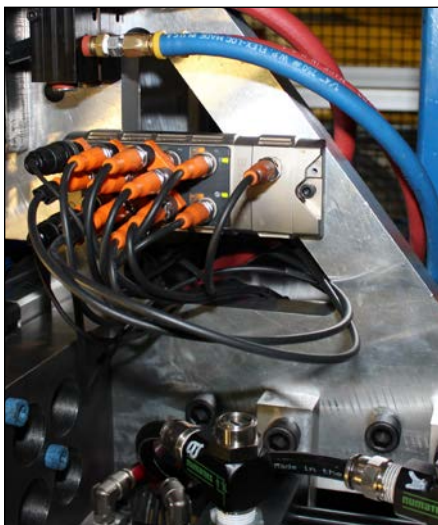


Figure 9: Discrete I/O poke-yoke sensors



Figure 10: EtherNet/IP IO-Link Master with smart pressure sensor

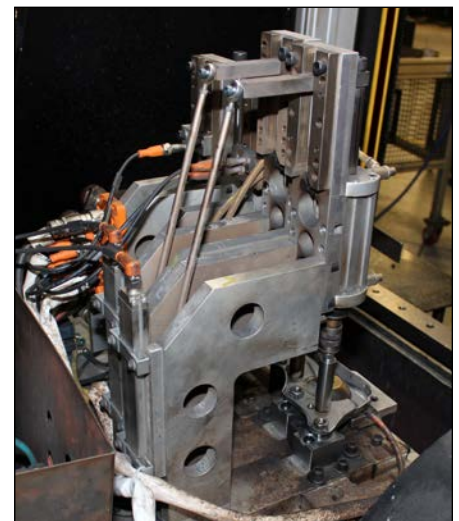


Figure 11: Linear position measurement functional in 20 minutes

What you should do next

The best way to see how IO-Link works with what you have and how it integrates is to setup a Continuous Improvement Lunch & Learn for your Quality Management Team to see the technology in action. Contact your Balluff representative to bring flexible easy and fast integration of continuous improvement to your organization today.

Contact us by phone and ask for inside sales: 800-543-8390

Contact us by email and ask for a Continuous Improvement Lunch & Learn: balluff@balluff.com

About the Author



Will Healy III lives in Cincinnati, OH and works out of Balluff's US headquarters in Florence, KY. He has over 9 years of experience in the automation and manufacturing industry and is the strategic marketing manager for Balluff globally on error proofing assembly processes. A longtime supporter of the adoption of IO-Link technology, Will is passionate about manufacturing automation and believes in supporting Science Technology Engineering and Math (STEM) programs in schools.

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About Balluff

Rugged Control Components from Network to Sensor

Balluff specializes in delivering dependable, rugged and precision products for industrial sensing, networking, and identification to help prevent downtime and eliminate errors. We are a complete system and component supplier, offering industrial network and I/O products for use outside of the control cabinet. We add value to automated systems by providing a wide range of enabling technologies that unlock hidden productivity potential.

Our products include a complete line of sensors, transducers, ID systems, and connectivity products. Our sensor lines include photoelectric, inductive, capacitive and magnetic, as well as other more specialized sensor products to fit virtually any sensing application.



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