

DISTRIBUTED MODULAR I/O FOR PNEUMATICS & HYDRAULICS

Using IO-Link to expand control and improve monitoring

White Paper

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Machinery builders who utilize pumps and valves in their equipment have various options when it comes to monitoring and controlling these industrial devices. In addition, when working with fluids and gasses, there is the need to monitor the state of the process using temperature, pressure, and flow measurements or even valve position feedback. The controls engineer is responsible for maintaining the cost effectiveness of the controls equipment while providing flexibility and monitoring in a highly competitive and increasingly global marketplace.

The development of the distributed modular I/O architecture has lowered the cost per point of the controls design and has reduced the time to integrate. The distributed modular I/O architecture utilizes the vendor-neutral industrial standard, IO-Link (www.IO-Link.com), which allows for easy, universal, smart devices to be integrated. It uses low-cost standard M12 4-wire unshielded cables which help keep the cost of communication low even while maintaining noise immunity. By implementing a master/slave relationship, up to 8 devices can be connected to one address of an industrial network. Distributed modular I/O architectures are IP67 which means they provide I/O that is machine mounted and can withstand all but the most hostile industrial environments in non-hazardous applications.

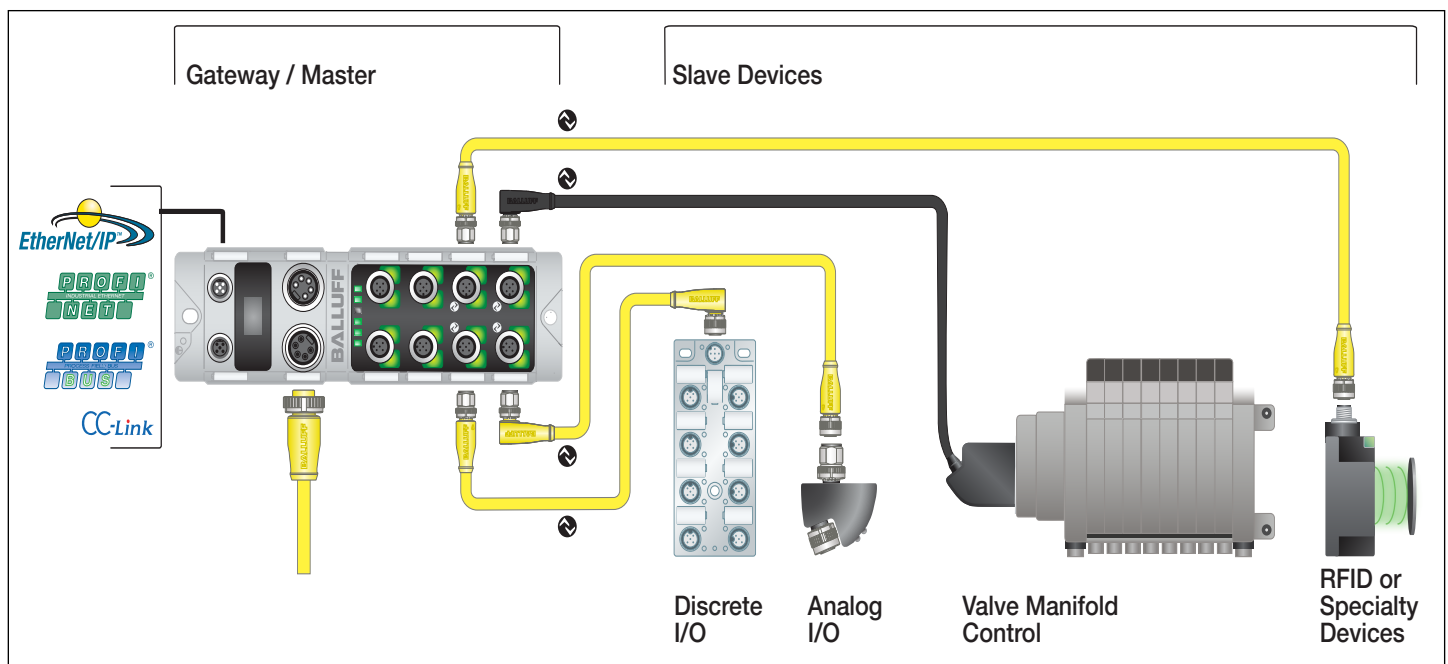


Figure 1: Distributed Modular I/O IP67 Architecture

Saving Costs with Pump and Valve Control

Today many machinery builders utilize a hardwired solution for the control of their pumps and valves in their automated machines. If looking at just the hardware, this seems to be the most cost effective solution to driving the output. However, when reviewing the total-cost-of-ownership, the assembly labor, and the cost of hardware (such as controls cabinets, terminal strips, etc.), the total cost to control the one valve or pump becomes much higher. Furthermore, if the machine has to be disassembled to ship and install at the customer, the rewiring of the equipment can cut directly into the overall margin of the project. Typical pneumatic valve manifold installations require terminating 25 wires and troubleshooting multiple connectors, making for a time consuming and costly installation in labor and equipment.

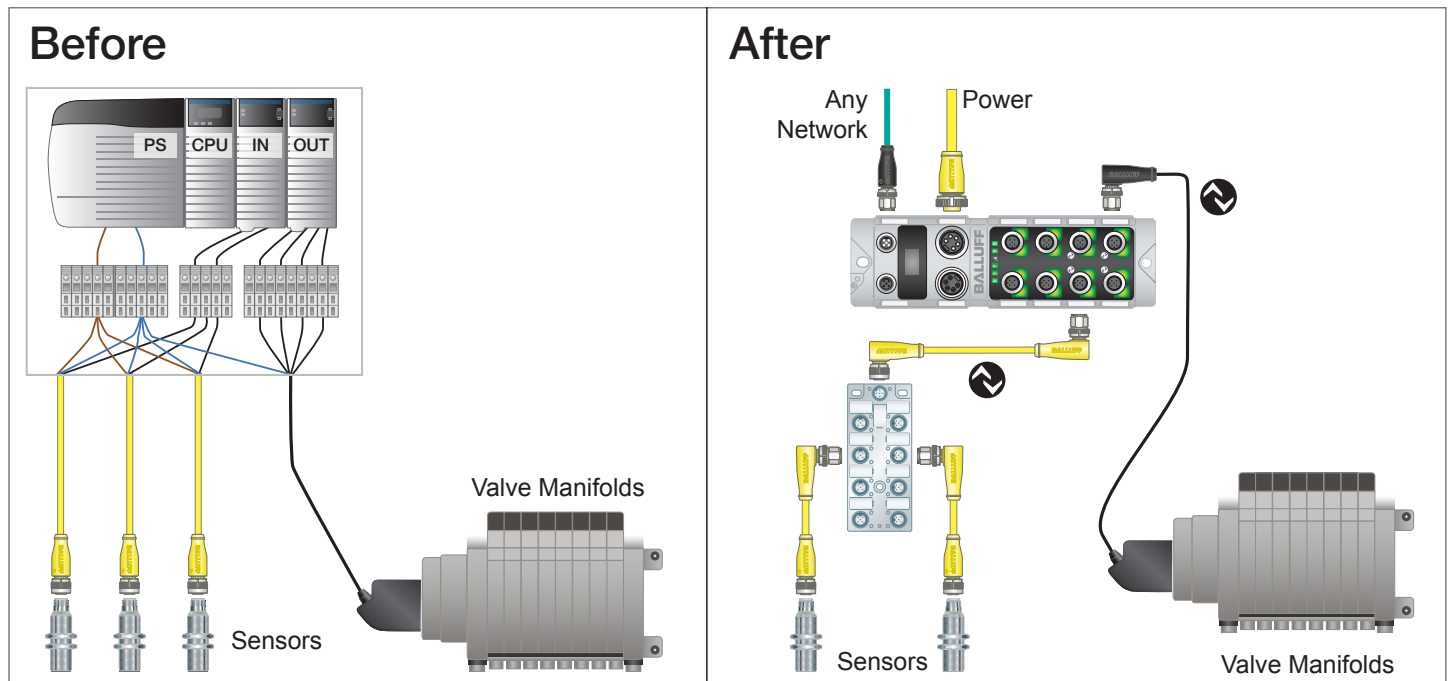


Figure 2: Reduction in Hardware & Labor with Distributed Modular I/O Valve Control

By using an industrial network and distributed modular I/O valve manifold connections, the time to install and troubleshoot these connections is dramatically reduced since the 25 terminations are digitally controlled over a simple M12 connection. The required space in the controls cabinet is reduced by removing the terminal strips and output card, and the time to have a machine running is shortened. This can allow the machine builder to potentially build more machines per year with the same resources. A recent customer study revealed that the customer was able to save over \$350 per manifold installed on their equipment by moving to this distributed architecture and dramatically reduced the labor involved in the construction of the controls.

When attempting to control pumps and valves in an installation less dense than a valve manifold, easy to use I/O devices can be integrated allowing for simple discrete or even analog control of the pump volume or valve position. In lieu of the terminals in the controls cabinet, standard industrial connectors make for easy work getting the devices up and running. With IO-Link devices from multiple vendors, it's even possible to keep track of things like counting cycles or measuring exact valve position.



Figure 3: Valve Control with Distributed Modular I/O saved the customer over \$350 per manifold.

Foolproof Sensor Setup for Monitoring

The machine builder that is incorporating pumps and valves into his equipment is being asked more and more to provide additional information to the enterprise level of the factory. Every end user wants to know about their process - what is failing and what is working well. They expect and demand more information out of their equipment to be visible to all levels of the organization.

One way to achieve this information is to integrate analog signals into the controls and sensors, but then you fight noise issues, ground loops, and all of the other intricacies of working with analog devices. One might think this can be easily fixed by implementing an industrial network, but typically it isn't cost effective to have an Ethernet enabled pressure switch or Profibus linear transducer. These devices can be more costly and they take up IP addresses, nodes, and connections for small amounts of data. In addition, every machine builder reuses parts of their old designs in new projects, like always building the same hydraulic power unit. Every build would require you to reprogram the 10 or more settings of the pressure sensor using the pushbuttons, a manual, and about 30 minutes of patience.

When facing any of these above challenges, there are two distinct advantages to implementing a distributed modular I/O with IO-Link solution. The first advantage is the ability to eliminate your fight with analog signals. The measurement or feedback data is converted to digital inside the device and is packaged as a simple set of bytes that are transmitted by the master over the industrial network, meaning no more noise issues to contest with. Costly shielded multi-conductor cables are replaced with standard 4-wire sensor cables. And best of all, no more expensive analog cards in your controls cabinet for just one channel of analog.

The second distinct advantage you gain by implementing IO-Link is the ability to store the parameters of the sensor/probe/transducer, and then download the settings to the device when needed from a PC or the controller. IO-Link devices can be programmed on the fly to virtually any configuration that is determined by the key parameters of the device. This allows for multiple settings to be stored and swapped while running, increasing the flexibility of applications. In the off chance that the end-user has to replace the device, the master has saved the most recent parameters and it can automatically download the settings into the replacement device, no pushbuttons needed

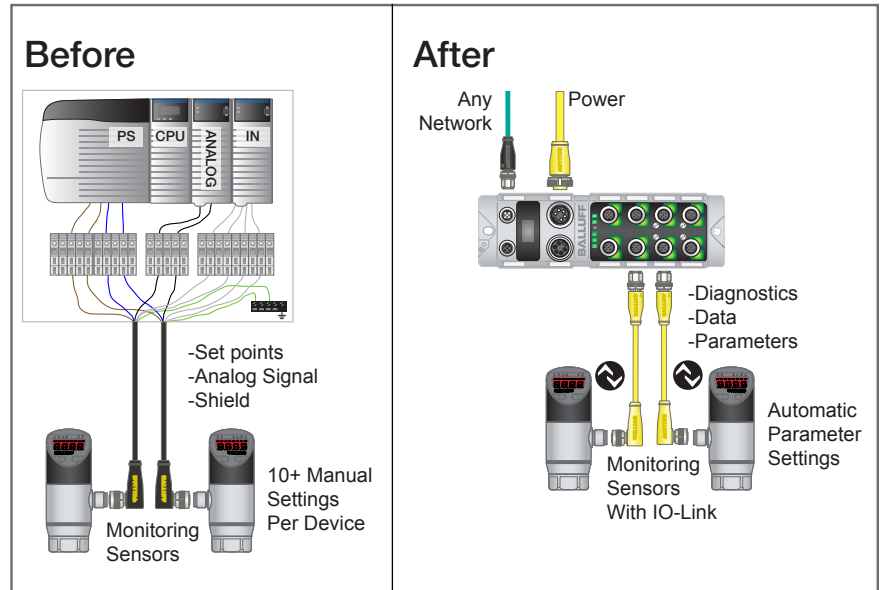


Figure 4: Foolproof and Simplified Installation of Monitoring Devices

Distributed Modular I/O with IO-Link

When machine builders integrate pumps, valves, and monitoring devices into hydraulic or pneumatic applications, distributed modular I/O can reduce the total cost of ownership of the machine, improve the speed of assembly, and ease the integration process. For end users, IO-Link can add flexibility to the machine, bring data to all levels of the plant, and ease troubleshooting problems for maintenance crews.

About the author



Will Healy III is the networking marketing manager for Balluff North America, based in Florence, KY.

IO-Link for Manufacturers

The Balluff IO-Link Advantage

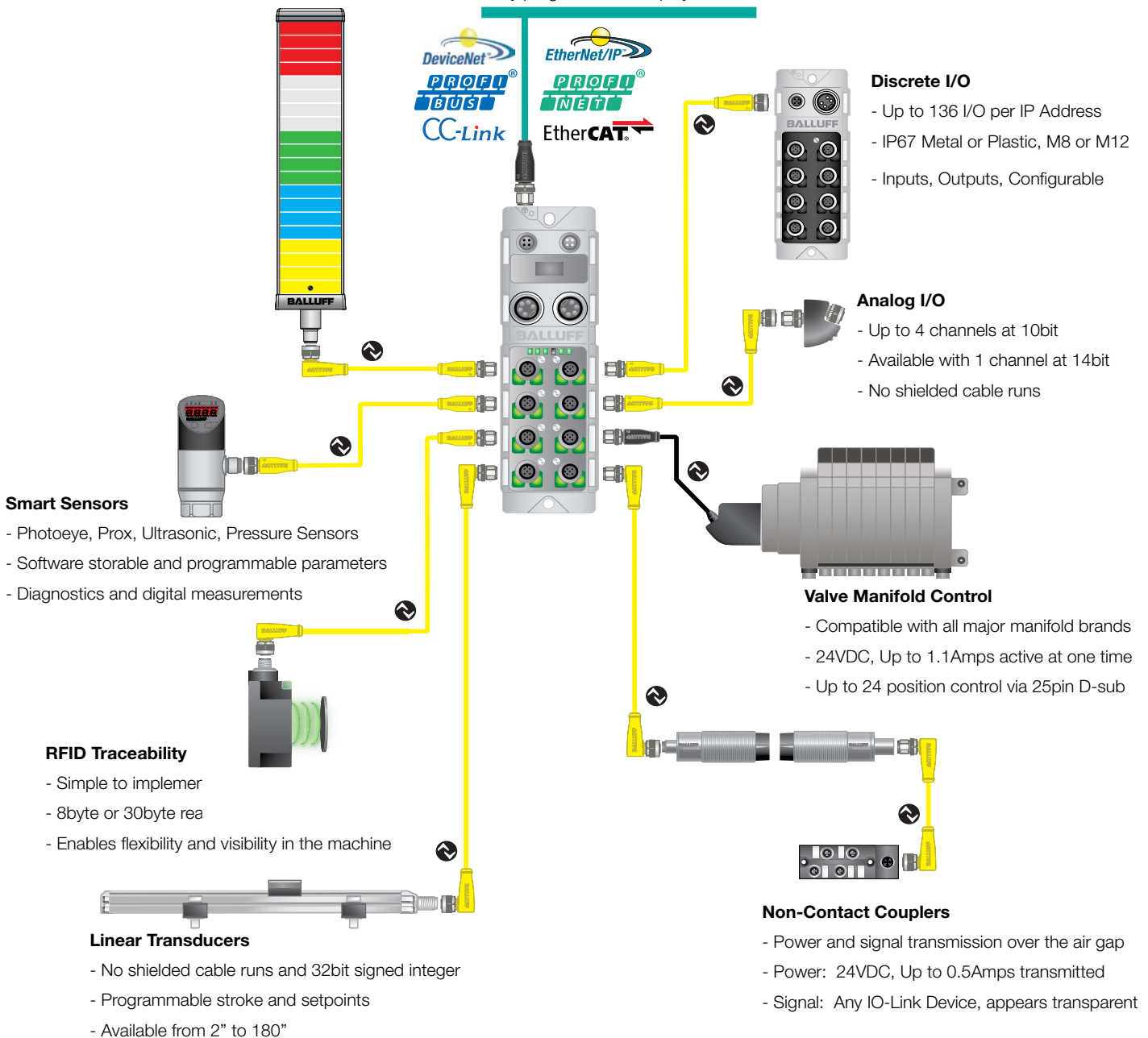
- ✔ Widely adopted use across many industries
- ✔ The broadest offering of IO-Link Devices
- ✔ Get more intelligent devices per IP Address
- ✔ Easily implement with tools like AOIs and Faceplates

Smart Light

- Stacklight Mode: 1-5 zones
- Level Mode: high/low level
- Configure: Colors, brightness, levels, etc.

IO-Link Masters

- 4port and 8port versions
- Parameter server functionality
- Fully programmable display



Smart Sensors

- Photoeye, Prox, Ultrasonic, Pressure Sensors
- Software storable and programmable parameters
- Diagnostics and digital measurements

RFID Traceability

- Simple to implement
- 8byte or 30byte read
- Enables flexibility and visibility in the machine

Linear Transducers

- No shielded cable runs and 32bit signed integer
- Programmable stroke and setpoints
- Available from 2" to 180"

Discrete I/O

- Up to 136 I/O per IP Address
- IP67 Metal or Plastic, M8 or M12
- Inputs, Outputs, Configurable

Analog I/O

- Up to 4 channels at 10bit
- Available with 1 channel at 14bit
- No shielded cable runs

Valve Manifold Control

- Compatible with all major manifold brands
- 24VDC, Up to 1.1Amps active at one time
- Up to 24 position control via 25pin D-sub

Non-Contact Couplers

- Power and signal transmission over the air gap
- Power: 24VDC, Up to 0.5Amps transmitted
- Signal: Any IO-Link Device, appears transparent

USA
Balluff Inc.
8125 Holton Drive
Florence, KY 41042
Phone: (859) 727-2200
Toll-free: 1-800-543-8390
Fax: (859) 727-4823
balluff@balluff.com

Canada
Balluff Canada, Inc.
2840 Argentia Road, Unit #2
Mississauga, Ontario L5N 8G4
Phone: (905) 816-1494
Toll-free: 1-800-927-9654
Fax: (905) 816-1411
balluff.canada@balluff.ca

Mexico
Balluff de México SA de CV
Anillo Vial II Fray Junipero Serra No. 4416
Colonia La Vista Residencial.
Querétaro, Qro. CP76232
Phone: (++52 442) 212-4882
Fax: (++52 442) 214-0536
balluff.mexico@balluff.com

