

“BUS OFF” ...  
CAN YOU CONTINUE TO AFFORD  
YOUR DEVICENET DOWNTIME?

**White Paper**

## “BUS OFF” ... CAN YOU CONTINUE TO AFFORD YOUR DEVICENET DOWNTIME?

### White Paper

**This white paper is intended for operations, maintenance and controls management who are concerned with the cost of downtime associated with failures of DeviceNet networks during production. This significant cost increases the cost of operations such as lost production, production overtime, cost of maintenance, expedited shipping etc. This paper proposes an IO-Link solution that will help you meet your production demands by reducing or eliminating these costs.**

In the current climate of shorter automotive program cycles and cost reduction initiatives it is common for companies to repurpose equipment for new programs by refurbishing their machines and building new tooling. As many of these machines may be 3-4 years old when DeviceNet was the leading networking technology. These machines go back into service with the same network.

As any of us who have worked with DeviceNet know the network integrity is at its best the day the machine was built and starts deteriorating from that point. How many of us have experienced the dreaded “Bus Off” error on the DeviceNet scanner, only to be left with no power on the network and left to use a process of elimination to find where the fault occurred? The “Bus Off” fault can be caused by a variety of issues but the most common causes are intermittent connections, short circuit or open circuit on the CAN lines due to damaged cables, defective devices or nodes such as network Tee’s etc. Downtime due to DeviceNet issues is a common occurrence at every manufacturing plant every day and causes significant downtime. This downtime costs companies tens if not hundreds of thousands of dollars per year in lost production and overtime. How can this issue be resolved?

Now that EtherNet/IP has become more commonly available you would think that it would be relatively easy to convert to EtherNet/IP. Unfortunately there is still a significant premium in cost to go from DeviceNet to EtherNet/IP. Generally for IO with high current requirements there is no POE capability with EtherNet/IP like there is with DeviceNet therefore every node needs an additional auxiliary power cable as well as a shielded network cable. The cost of EtherNet/IP nodes themselves are also still significantly higher than DeviceNet nodes that has been on the market for many years.

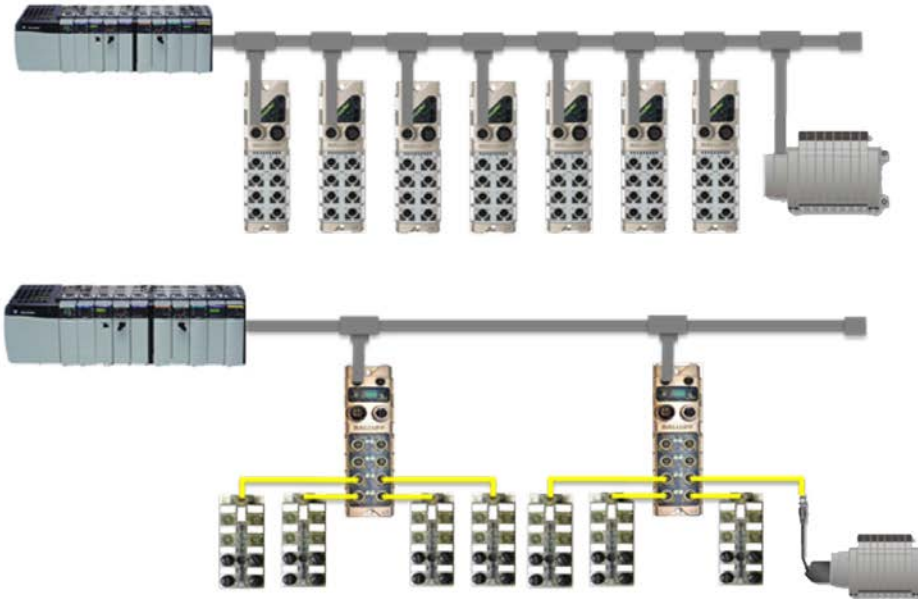
One way to reduce the number of errors on your DeviceNet networks would be to simplify your network by reducing the number of nodes and length of cabling on each segment of the network. This would require adding scanner cards and splitting the network into smaller segments, also limiting the number of nodes per segment to make it easier to troubleshoot.

A new and innovative way to achieve the same result is by reducing the size of the DeviceNet network by replacing the DeviceNet IO blocks and expensive Valve Manifold nodes with cost effective IO-Link I/O hubs and valve connectors.

IO-Link is an innovative vendor neutral technology. It uses powerful point to point communication for up to 32 bytes of input data and 32 bytes of output data from IO-Link slaves such as hubs that pick up IO to an IO-Link Master that resides on the physical network such as DeviceNet, EtherNet/IP, PROFINET and more. The beauty of this technology is that even though it is more intelligent with many more features, it is quite simple to use and more cost effective. This makes IO-Link a simple expansion to an existing network currently implemented by the user.

### So how does IO-Link do this? Let’s explain further:

The IO-Link Master would remain on the DeviceNet network but the new IO-Link hubs and valve connectors are arranged in a star configuration from the master making it significantly easier to troubleshoot. The IO-Link Hubs can be up to 20 meters from the master using standard “off the shelf” 3 or 4 wire “prox” cables, no custom or proprietary cabling is required. Power for the IO-Link hubs is supplied through that “prox” cable from the IO-Link Master therefore no additional Aux power cable is required either. The IO-Link hubs also require no addressing making it easier for maintenance to replace a device without any special training. IO-Link hubs are also significantly less expensive than EtherNet/IP blocks as there is no fee for the expensive Ethernet chip set.



A second and more common method of reducing downtime from DeviceNet is by replacing the DeviceNet network entirely with a cost effective EtherNet/IP IO-Link conversion. Several major Tier 1 automotive suppliers have now undertaken this conversion with significant results in eliminating network issues. Examples such as losing 8-10 hours per month of machine downtime on a single piece of equipment were common for these customers. This downtime has now been eliminated by an IO-Link conversion.

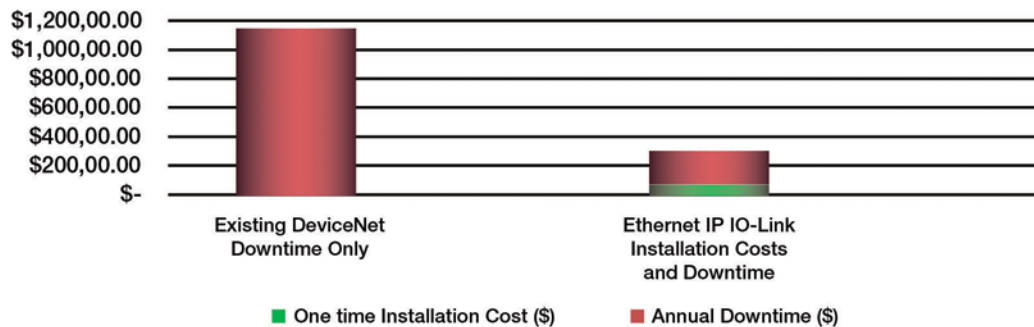
## IO-Link Cost Savings Example

Background Information:

1. Consideration for automated production line with 24 weld cells
2. Cost of downtime per hour = \$12,000.
3. Avg. number of hours per month of downtime with existing DeviceNet only architecture = 8hrs.
4. Ethernet IP IO-Link reduces the down-time to estimated 1hr. per month
5. Installation costs include hardware and labor, \$50,000 for hardware, \$28,800 for labor (24 cells x 8 hrs x \$150)

Observations:

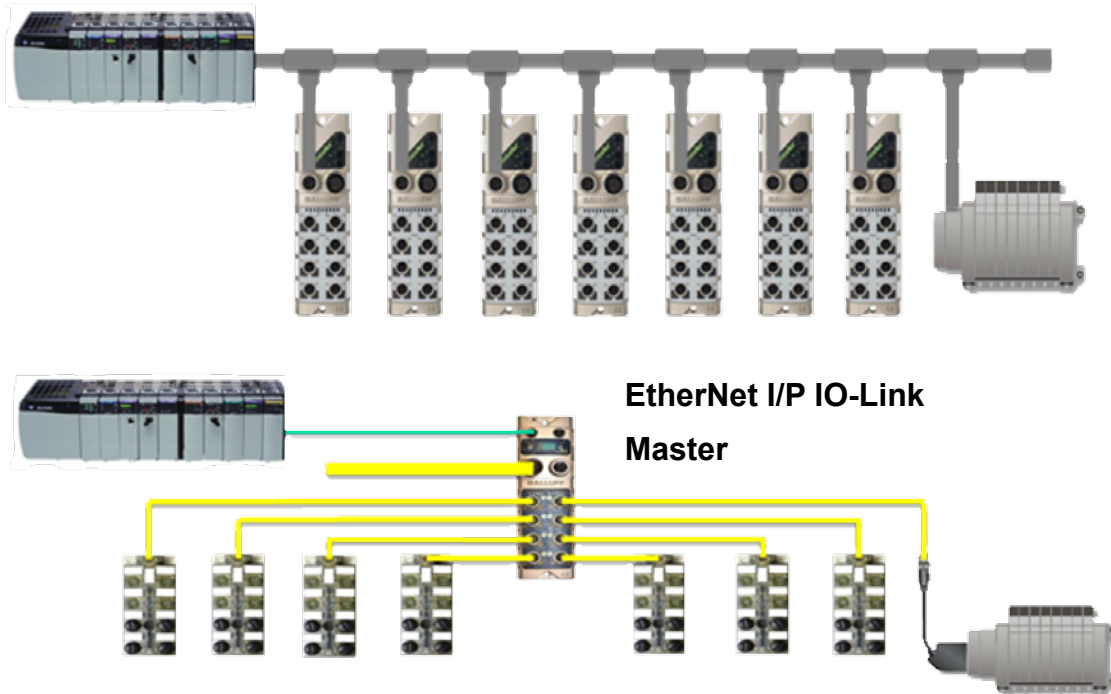
1. Installing IO-Link has a return on investment of less than two months



A graph illustrating an example of savings with IO-Link architecture: Elimating DeviceNet related downtime with IO-Link

The convenience of a conversion from DeviceNet to IO-Link solution is the ability to prepare all the hardware and software changes in parallel to the existing network, testing everything and ensuring that it is all functioning correctly while in all cases keeping the existing equipment in production. The switch over from DeviceNet to EtherNet/IP IO-Link is then as simple as moving the IO cables from the DeviceNet blocks to the IO-Link hubs on a planned shutdown.

The point to point configuration of the IO-Link system allows for simple and easy diagnosis of cabling or device faults without taking down the complete network. The network power stays on and the fault is easily identified by the indication LED's on the IO-Link Master or through the error bits sent to the PLC. The IO-Link hubs are also available with individual port short circuit indication and individual overload indication and diagnostics to reduce downtime.



IO-Link version 1.1 has been proven to be reliable in production in welding applications. As the IO-Link digital signal operates at a 24 VDC level, it has been proven to be very stable in high noise environments. A wide variety of IO-Link enabled devices are now also available. IO-Link devices such as analog devices and intelligent sensors can be mixed from any manufacturer since IO-Link is a Vendor Neutral Technology.

For more information on IO-Link, visit [www.balluff.com](http://www.balluff.com)

## 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 or email and ask inside sales for a Networking & IO-Link Lunch & Learn:

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## About the Author

Tom O'Connell is based out of the Balluff Canada headquarters in Mississauga, Ontario. He has over 37 years' experience in the automation industry, over 25 years of that in the automotive sector in machine design, machine building and sales. Tom is currently a Business Development Manager at Balluff Canada. He can be reached at [thomas.o'connell@balluff.ca](mailto:thomas.o'connell@balluff.ca)

## 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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